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U. S. DEPARTMENT OF AGRICULTURE.
DIVISION OF ENTOMOLOGY.
BULLETIN No. 8.
(SECOND EDITION.)

THE PERIODICAL CICADA.

AN ACCOUNT OF CICADA SEPTENDECIM AND ITS TREDECIM RACE, WITH A CHRONOLOGY OF ALL BROODS KNOWN.

BY

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DEPARTMENT OF AGRICULTURE,
DIVISION OF ENTOMOLOGY,
Washington, D. C., May 25, 1885.

SIR: I have the honor to submit for publication Bulletin No. 8 from this Division. On account of the concurrence the present year of two extensive broods of the Periodical Cicada, the one a 17-year, the other a 13-year brood, the inquiries in reference to this insect will be exceptionally numerous, and have, in fact, already begun to reach the Department. With the view of meeting the demand for information upon the subject, and with the further view of soliciting data that will enable me to more completely map out the geographical limits of these two broods, I have prepared this Bulletin. It is based upon an article published seventeen years ago, in my First Report on the Insects of Missouri, and is in fact to be looked upon as a revised edition of that article, with the omission of such passages as had but a local or temporary interest, and the addition of such chronological data as I have accumulated during the intervening time.

Respectfully.

C. V. RILEY,
Entomologist.

Hon. NORMAN J. COLMAN,
Commissioner of Agriculture.

THE PERIODICAL OR SEVENTEEN-YEAR CICADA AND ITS THIRTEEN-YEAR RACE.

The metamorphoses of insects, their instructive industry, their quarrels and their instincts afford abundant food for our love of the marvelous; but few species can claim such a singular history as can our Periodical Cicada. We are moved to admiration in contemplating the fact that an insect, after living for nearly seventeen years in the bowels of the earth, should at last ascend from its earthy retreat, change its sluggish, creeping, and wingless form, and, endowed with the power of flight, become a denizen of the air and enjoy the full glory of the sun. But our wonder increases when we reflect that this same insect has appeared in some part or other of the United States at regular intervals of seventeen years for centuries, aye, for ages, in the past! Long ere Columbus trod American soil this lowly insect must have appeared regularly at its appointed time. It must have filled the woods with its rattling song, when none but while beasts and savages were present to hear it. To me there is something pleasant in the idea that through its periodicity we are enabled with tolerable certainty to go back in thought, for centuries in the past, to a particular month of a particular year, or even to a given day, when the woods resounded with its song in the same manner as they did in 1868, or will the present year.

It was my good fortune to discover that besides the 17-year broods, the appearance of one of which was recorded as long ago as 1633, there are also 13-year broods;* and that, though both sometimes occur in the same States, yet in general terms the 17-year broods may be said to belong to the northern and the 13-year broods to the southern States, the dividing line being about latitude 38°, though in some places the 17-year broods extend below this line, while in Illinois the 13 year broods run up considerably beyond it.†

* See *Journal of Agriculture*, Saint Louis, June 13, 1868.

† Four months after I had published the above discovery I was gratified to find that Dr. Gideon B. Smith, of Baltimore, Md., in an unpublished manuscript communicated to me by Dr. J. G. Morris, of the same city, had made the same discovery, though he had never given it to the world: while five years later I learned through correspondence with Dr. D. L. Phares, of Woodville, Miss., that he had even anticipated Dr. Smith. There is nothing in Dr. Smith's manuscript to show that he was led to his conclusion by Dr. Phares, but the latter has, in *Southern Field and Factory* (published at Jackson, Miss.) for April, 1873, an extended article in which he claims to have published the fact of a periodical 13-year brood in the *Woodville* (Miss.) *Republican*

It so happened that one of the largest 17-year broods, together with one of the largest 13-year broods, appeared simultaneously in the summer of 1868. Such an event, so far as regards these two particular broods, had not taken place since the year 1647, nor will it take place again till the year 2089.

There are absolutely no perceptible specific differences between the 17-year and the 13-year broods, other than in the time of maturing; but while the insects forming these two classes of broods are not specifically distinct, they are good and distinct races which do not cross, and I have therefore, for convenience sake, named the 13-year broods *Cicada tredecim*.

TWO DISTINCT FORMS.

It is not a little singular, also, that two distinct forms occur in both races—a large one and a small one—the former by far more numerous than the latter. This fact has been observed in past years, and was

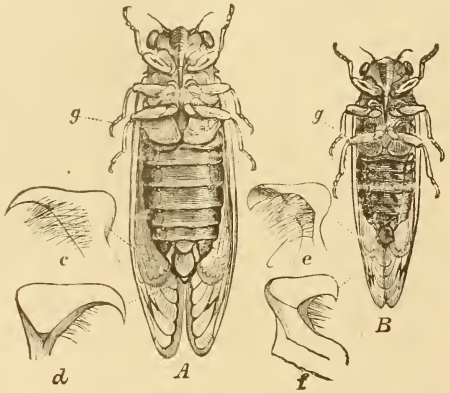

FIG. 1.—Seventeen-year Cicada. A, ♂ of typical form; *c*, *d*, genital hooks; *g*, singing apparatus. B, ♂ of the small form (*cassinii*); *e*, *f*, genital hooks. (After Riley and Hagen.)

noticed in 1868 by independent observers in different parts of the country.* Indeed, it was observed by Dr. Hildreth, of Marietta, Ohio, as far back as 1830 (*vide* Silliman's Journal, XVIII, p. 47). The true *Cicada septendecim* of Linnæus (Fig. 1 *A*, ventral view of male), as

as early as May 17, 1845, where he controverted Dr. Smith's position to the effect that there were no 13-year broods; and that in the same paper, for May 5, 1858, he published another notice, headed "*Cicada Tredecim*." It was not till 1873 that I became aware of these facts, though I had previously been in correspondence with Dr. Phares; and though I have made every effort since to obtain a copy of the original article to which Dr. Phares refers, both he and myself have utterly failed to do so. While, therefore, it appears that Dr. Phares has trusted to memory for the dates here given, there is no reason to doubt the essential accuracy of the facts, and that to him rather than to Dr. Smith belongs the discovery of one of the 13-year broods of this Cicada, and the credit of having first published the fact.

* 1. Mr. V. T. Chambers, in the August (1868) number of the *American Naturalist*, p. 332, is said to point out some variation in color from those described by Dr. Fitch.

2. Mr. S. S. Rathvon favored me with specimens of both species from Lancaster

described by Harris and Fitch, occurs in the greatest numbers, both in the 17- and 13-year broods. It will measure, on an average, 1½ inches from the head to the tip of the closed wings, and almost always expands over 3 inches. The whole under side of the abdomen is of a dull orange-brown color, and, in the male more especially, four or five of the segments are edged with the same color on the back.

The other form (Fig. 1 *B*, ventral view of male) is not, on an average, much more than two-thirds as large, and usually lacks entirely the dull orange abdominal marks, though there is sometimes a faint trace of them on the edges of the segments beneath. This small form was described in 1851, by Dr. J. C. Fisher, in the "Proceedings of the Philadelphia Academy of Natural Sciences," vol. V, pp. 272–273, as a new species of Cicada, hitherto confounded with *septendecim*, and was named *Cicada cassinii*. His description was followed by a note from Mr. John Cassin, in which the latter states that the two forms show no disposition to associate together, and produce very different cries. The fact of the very great difference in the song of the males has been fully confirmed by the observations of M. C. Hill, of northeastern Ohio, who likewise found that the small form is very much less numerous than the large one.

The truest test of the specific distinction of these two forms lies in the comparative shape of the male genitalia, and the accompanying figures (*c*, *d*, *e*, and *f*, in Fig. 1), from drawings made in 1868 by Dr. H. A. Hagen, of Cambridge, Mass., show the male genital hooks of both. That of *septendecim* is represented on the outside at *c*, on the inside at *d*; and that of *cassinii* on the outside at *e*, and on the inside at *f*.

By these figures it will be seen that there are sufficient differences to separate the two forms as distinct: but while the hooks of the large kind (*septendecim*) are quite constant in their appearances, those of the smaller kind (*cassinii*) are variable, and in some few specimens are indistinguishable from those of the large kind. This circumstance, coupled with the fact that the small kind regularly occurs with both the 17- and 13-year broods, would indicate it to be a dimorphic form of the larger, and only entitled to varietal rank.

The large form has been observed to make its appearance from eight to ten days earlier than the small form (*cassinii*), and there is not a single specimen of the latter, among a number of the 13-year brood (*tredecim*) that I captured in May, 1868, though I took a few specimens afterward.

THE SEASON OF THEIR APPEARANCE AND DISAPPEARANCE.

The season of their appearance and disappearance differs somewhat with the latitude, though not so materially as one might suppose.

County, Pennsylvania, accompanied with the following: "I am justified, I think, in concluding these are two distinct species. They are different in size and coloration, produce entirely different stridulation, do not cohabit indiscriminately," &c.

3. The correspondent to the Department of Agriculture (July [1868] Rept.) from Hematite, Mo., says: "There are two species, one (both male and female) about twice the size of the other, and differing greatly, also, in their cries and actions."

According to the records they appeared in 1868 earlier in the South than in the North; but the last half of May can be set down as the period during which they emerge from the ground in any part of the country, while they generally leave by the 4th of July. In Saint Louis County, Missouri, in 1868, they commenced issuing on the 22d of May, and by the 28th of the same month the woods resounded with the rattling concourse of the perfect insect. As is the case with a great many other insects, the males make their appearance several days before the females, and also disappear sooner. Hence, in the latter part of the Cicada season, though the woods are still full of females, the song of but very few males will be heard.

That circumstances favorable or otherwise may accelerate or retard their development was accidentally proven, in 1868, by Dr. E. S. Hull, of Alton, Ill., as by constructing underground flues for the purpose of forcing vegetables, he also caused the Cicadas to issue as early as the 20th of March, and at consecutive periods afterwards till May, though, strange to say, these premature individuals did not sing. They frequently appear in small numbers, and more rarely in large numbers, the year before or the year after their proper period. This is more especially the case with the 13-year brood. Thus, in Madison County, in Illinois, and in Daviess and Clark Counties, in Missouri, there were in 1854 a few precursors of the true 1855 brood. They were also ob-

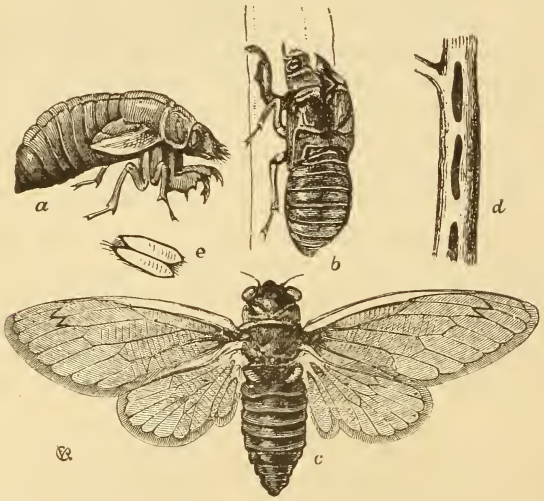

FIG. 2.—Seventeen-year Cicada: *a*, pupa; *b*, cast pupa shell; *c*, imago; *d*, punctured twig; *e*, two eggs. (After Riley.)

served in Madison County, Illinois, in 1867, while "L. W.", writing from Guntersville, Ala., to the *Country Gentleman*, of June 25, 1868, says, "some call them 14-year locusts." Other such cases will be noticed hereafter.

The natural history and transformations of the species have been described in the standard works of both Harris and Fitch, and in this connection I will merely mention a few facts not recorded by these authors.

Mr. S. S. Rathvon, of Lancaster, Pa., who has himself witnessed four of their periodical visits, at intervals of seventeen years, discovered the following very ingenious provision which the pupæ (Fig. 2, *a*) made, in 1868, in localities that were low or flat, and in which the drainage was imperfect. He says: "We had a series of heavy rains here about the time of their first appearance, and in such places and under such circumstances the pupæ would continue their galleries from 4 to 6 inches above ground (Fig. 3, *a* full view, *b* sectional view), leaving an orifice of egress even with the surface (Fig. 3, *e*). In the upper end of these chambers the pupæ would be found awaiting their approaching time of change (Fig. 3, *c*). They would then back down to below the level of the earth, as at *d*, and issuing forth from the orifice, would attach themselves to the first object at hand and undergo their transformations in the usual manner." Mr. Rathvon kindly furnished me with one of these elevated chambers, from which the accompanying drawings were made. It measured about 4 inches in length, with a diameter on the inside of five-eighths of an inch, and on the outside of about 1¼ inches. It was slightly bent at the top and sufficiently hard to carry through the mail without breaking. The inside was roughened with the imprints of the spines with which the fore legs of the builder are armed. In a field that was being plowed near Saint Louis, about the time of their ascent, I found that single, straight or bent, chambers were the most common, though there were sometimes several branching near the surface from a main chamber below, each of the branches containing a pupa. The same observations have been made by other parties. These holes are cylindrical and are evidently made by appressing the earth on all sides and throwing the refuse to the bottom, which must be quite a feat when they penetrate hard roads or come up between two rocks, as they frequently do.

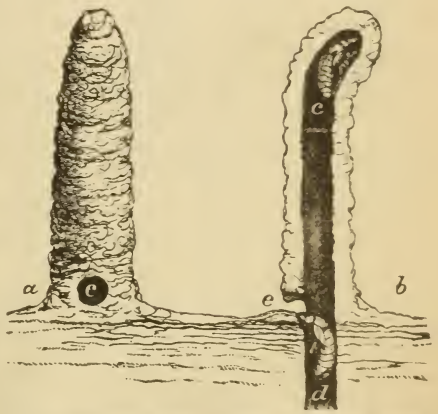

FIG. 3.—Seventeen-year Cicada: Galleries made by pupa: *a*, front view; *e*, orifice; *b*, section; *c*, pupa awaiting time of change; *d*, pupa ready to transform. (After Riley.)

The larvæ are frequently found at a great depth, notwithstanding the denial of the fact. Thus, Mr. Henry Sadorus, of Port Byron, Ill., who built a house in 1853, found that they came up through the bottom of his cellar in 1854, the cellar being over 5 feet deep, and Mr. F. Guy, of

Sulphur Springs, informed me that he had found them at a depth of 10 feet below the surface.

When ready to transform they invariably attach themselves to some object, and, after the fly has evolved, the pupa skin is left still adhering, as shown at Fig. 2, *b*. The operation of emerging from the pupa most generally takes place between the hours of 6 and 9 p. m.; and ten minutes after the pupa skin bursts on the back the Cicada will have entirely freed itself from it. Immediately after leaving the pupa skin the body is soft and white, with the exception of two black patches on the prothorax. The wings are developed in less than an hour, but the natural colors of the body are not acquired till several hours have elapsed. These recently-developed Cicadas are somewhat dull for a day or so after transforming, but soon become more active, both in flight and song, as their muscles harden. For those who are not informed of the fact, I will state that the males alone are capable of "singing," and that they are true ventriloquists, their rattling noise being produced by a system of muscles in the lower part of the body, which work on the drums under the wings, shown in Fig. 1, at *g g*, by alternately tightening and loosening them. The general noise, on approaching the infested woods, is a combination of that of a distant thrashing machine and a distant frog pond. That which they make when disturbed mimics a nest of young snakes or young birds under similar circumstances—a sort of scream. They can also produce a chirp somewhat like that of a cricket, and a very loud, shrill screech, prolonged for fifteen or twenty seconds, and gradually increasing in force and then decreasing.

After pairing, the females deposit their eggs in the twigs of different trees; and though for this purpose they seem to prefer the oaks and the hickories, they oviposit in almost every kind of deciduous tree, and even in herbaceous plants and in evergreens. I have seen their eggs in the Chestnut, Locust, Willow, and Cottonwood, in peach twigs of not more than one-eighth of an inch in diameter, and also in the stems of the common Eupatorium; while R. H. Warder, of Cleves, Ohio, has found them in the following evergreens: *Thuja occidentalis*, *Juniperus virginiana*, and *Abies canadensis*, but was unable to find any traces of their work in either of our common pines—*Pinus austriaca*, *P. strobus*, or *P. sylvestris*.

Dr. Harris (*Inj. Ins.*, p. 212) has well described the mode of ovipositing, and it is only necessary to add that the female always saws with her head upwards, *i. e.*, towards the terminal part of the branch, except when she comes in contact with a side shoot, when, instead of shifting a little to one side, she reverses her position, and makes two punctures in an opposite direction to the rest, and thus fills up the straight row close to the base of the side shoot. The eggs (Fig. 2, *e*) are of a pearl white color, one-twelfth of an inch long, and taper to an obtuse point at each end. They are deposited in pairs, but separated by a strip of

wood, which is wider—and thus causes the eggs to be further apart—at the bottom of the grooves than at their commencement. The punctured twigs bear the appearance of Fig. 4, and frequently break off and die, though the great majority remain green and recover from their wounds. Indeed there is every reason to believe that the eggs seldom hatch in those twigs which break off and become dry, but that the life and moisture of the twig are essential to the life and development of the egg, for the eggs are noticeably larger just before hatching than when first deposited, showing that they are, to a certain extent, nourished by endosmosis of the juices of the living wood. Mr. Rathvon has also recorded the fact that the Cicada eggs are always shriveled in twigs that are amputated by the Oak-pruner (*Stenocorus villosus*, Fabr.). In the healing of the punctured parts a knot usually forms over each puncture, and I represent at Fig. 5 a portion of an apple twig, sent to me by Mr. John P. McCartney, of Cameron, Clinton County, Mo., and which was punctured in the year 1862. Though the wounds had so well healed on the outside, the grooves inside were not filled up, but still contained the minute, glistening egg-shells, from which the young larvæ had escaped six years before.

Fig. 4.—Twig punctured by the Seventeen-year Cicada.

Fig. 5.—Twig healed after the puncture of the Seventeen-year Cicada.

The eggs hatch between the 20th of July and the 1st of August, or in about six weeks after being deposited. The newly-hatched larva (Fig. 6) differs considerably from the full-grown larva, but principally in having much longer and distinctly 8-jointed antennæ.* It is quite active, and moves its antennæ as dexterously and as rapidly as does an ant. As soon as it has extricated itself from an exceedingly fine membrane (the amnion), which still envelops it after it has left the egg,† our little Cicada drops deliberately to the ground; its specific gravity being so insignificant that it falls through the air as gently and as softly as does a feather.

Fig. 6.—Seventeen-year Cicada. Newly hatched larva. (After Riley.)

* There is frequently a ninth joint partly developed.

† Most insects having incomplete metamorphoses are enveloped in a like membrane after leaving the egg, and until this is thrown off the young insect is awkward in its motions. In the case of the young Cicada, these fine membranes are usually left attached to the roughened orifice of their nidus, and thus form, together, a white, glistening bunch.

The cross-veins near the tips of the upper wings of the Periodical Cicada form a dusky zigzag mark in the shape of a W. Some persons are silly enough to believe that this mark portends war. It occurs alike, though not to such a marked degree, on all other Cicadas, and if people must have an omen let them rather take the two W's for *warm weather*, and it will not be likely to disappoint them.

ENEMIES OF THE CICADA.

Upon leaving the ground to transform, the pupæ are attacked by different quadrupeds, by birds, and by cannibal insects, such as Ground-beetles, Dragon-flies, Soldier-bugs, &c., while hogs and poultry of all kinds greedily feast upon them. In the perfect fly state they are attacked by at least one insect parasite, for dipterous maggots (the larvæ, probably, of some Tachina fly) may occasionally be found in their bodies. In this state they are also often attacked by a peculiar fungus, which was noticed by Dr. Jos. Leidy, in the Proceedings of the Philadelphia Academy of Natural Sciences for 1851, p. 235, and has since been described as *Massospora cicadina* by C. H. Peck (31st Rept. N. Y. State Mus. Nat. Hist., p. 44, 1879). Dr. W. D. Hartman, of West Chester, Pa., speaking of the occurrence of this fungus, in 1851, says: "The posterior part of the abdomen, in a large number of male locusts, was filled by a greenish fungus. * * * The abdomen of the infected males was unusually inflated, dry, and brittle, *and totally dead while the insect was yet flying about.* Upon breaking-off the hind part of the abdomen, the dust-like spores would fly as from a small puff-ball." One male specimen, received in 1868 from Pennsylvania, was affected by the same or a similar fungus, the internal parts of the abdomen being converted into what appeared to be a brown mold.

R. H. Warder, of Cleves, Ohio, in speaking of this mold, says: "It seemed to be a drying up of the contents and membranes of the abdomen, generally of a brown color, and dry and brittle. I found that in many cases the male organs of generation remained so firmly attached to the female during copulation that the male could only disengage himself by breaking away, leaving one or two posterior joints attached to the female, and it is these mutilated males which I found affected by the peculiar fungus mentioned, and therefore concluded that the 'dry rot' might be the result of the broken membranes. I never found one thus affected in the very early part of their season, and I never found a perfect male thus affected. But this is not positive proof."

THE SUPPOSED STING OF THE PERIODICAL CICADA.

It is astonishing what a wide-spread fear exists of the Cicada on account of its supposed stinging power. There is scarcely a paper in the United States but published some account of a "locust" sting in 1868, while unpublished accounts were equally numerous. One of the editors

of the Saint Louis *Republican* was kind enough to clip out for me all accounts of such stings which he found in its numerous exchanges, and the number which had accumulated before the end of the "locust" season was truly surprising. Some people even denied themselves the pleasure of eating blackberries, raspberries, and other fruits, because they feared these fruits had been poisoned by the eggs of Cicadas, while others believed that the insects poisoned water. I have endeavored to trace a number of these reports, but have invariably found that they were either false or greatly exaggerated, and there is no doubt whatever that the great majority of such accounts owe their origin to the fertile imaginations of newspaper reporters, who are ever ready for the sensational. Yet, as the saying goes, it is strange there should be so much smoke and no fire, and I will briefly review the only three methods by which such stinging can possibly be produced. At the same time I give it as my conviction that there is but little cause for fear, as I have handled thousands of them, and know hundreds of persons, including children, who have done the same, and yet have never been able to witness a single case of bona fide stinging by the Cicada.

By hornets.—There is a very large digger-wasp (*Stizus grandis*, Say), the habit of which is to provision its nests with Cicadas. The burrows made by this digger-wasp, or hornet, are about 3 feet long, with two or three galleries about 1 foot long, each terminating in a chamber considerably enlarged. The female catches a Cicada, which she stings and paralyzes, and drags into one of these chambers; and it is not very unlikely that she should occasionally alight on some human being with a Cicada in her grasp, and upon being brushed off, should retaliate by stinging the offender, and then fly off, leaving the Cicada behind, which, in absence of the hornet, would very naturally be accused of the sting. An allied species of digger-wasp (the *Stizus speciosus* of Say)* has been actually observed by Mr. Rathvon to carry off a few belated individuals of the Periodical Cicada; but the usual prey of both of these species is the larger annual Cicada (*C. pruinosa* Say), and they both occur too late in the season to be the cause of all the stinging we hear of.

By the ovipositor.—The ovipositor of the female (Fig. 8, *b*) is certainly capable of inflicting a wound, but the Cicada is anything but pugnacious, and when not in the act of ovipositing, this instrument is securely inclosed in its sheath. That this is the stinging instrument is rendered extremely doubtful, for the following reasons: (1) All the stinging we hear of has been done suddenly, while the insertion of the ovipositor would necessarily be a gradual operation, requiring at least one minute; (2) the real function of the ovipositor is to convey an egg

* These wasps are now referred to the genus *Sphecius* Dahlb. and both *grandis* Say and *speciosus* Say ranked as one species, the former sinking to a varietal name of the latter, which has priority. (See W. H. Patton on "The Am. Bembecidæ: Tribe Stizini," Hayden's U. S. Geol. and Geogr. Survey, Bull. V, 1879, pp. 341–347.)

into the wound which it makes, and I have been unable to trace a single case where eggs were found in the flesh. All such accounts have proved to be fabrications, and the straightforward report which Mr. V. T. Chambers, of Covington, Ky., gave in the August (1868) number of the *American Naturalist*, of a negro being stung on the foot by a Cicada, proved, after all, to be a mistake, for "Mr. Winston did not see the insect with its instrument *in situ*;" (3) the three following facts, which are reliable, prove that stinging, in the usual sense of the term, by this instrument, is almost impossible: *First*, Mr. William Muir, associate editor of *Colman's Rural World*, carefully lifted a female from off a tree while she was yet in the act of ovipositing, and as carefully placed her on his little finger, holding it as near as possible in the same direction and position as the branch grew from which she was taken. She instinctively endeavored to continue ovipositing, and, holding firmly to his finger, tried again and again to insert the ovipositor, but without the least success, for it could not make the least impression on the soft and yielding flesh, but continually slipped from one side to the other. *Second*, it is recorded that Mr. Peter A. Brown, of Philadelphia, Pa., himself inflicted a puncture with the ovipositor, several times, upon his hand, without experiencing any more pain than that produced by the prick of a pin or any other pointed instrument, and that no swelling ensued. *Third*, Dr. Hartman, of Pennsylvania, introduced some of the moisture from the ovipositor into an open wound and it caused no inflammation whatever.

FIG. 8. — Seventeen-year Cicada, side view of ♀ to show beak. *a*, and ovipositor, *b*. (After Riley.)

BY THE BEAK, OR HAUSTELLUM.—The beak (Fig. 8, *a*) is an organ which both sexes of the Cicada possess, and by which they take their nourishment. I have seen them insert it into and extricate it from the branches of different trees, and know that the operation is quite rapid, and that the instrument must be quite sharp and strong. All the more authentic cases of stinging indicate this to be the instrument,* and it is quite likely that, just as the sting of a bee will affect some persons nigh unto death, and have no effect whatever on others, so the puncture

* Mr. D. B. Wier, of Lacon, Ill., who well knows the difference between the male and female Cicada, recollects distinctly that when they were there in 1854 he was stung in the finger by the male, the sting not causing very severe pain.

Mr. R. T. Parker, of Saint James, Phelps County, Missouri, an intelligent fruit grower, who has given some time to the study of insects, informed me that he was stung on the neck by a male Cicada, evidently with the beak, and that the sting was not so painful as that of a bee.

Dr. M. M. Kenzie, of Centerville, Reynolds County, Missouri, has communicated the fact that Frank Smith, aged fourteen years, living on Henpeck, in the lower part of Reynolds County, was stung by a Cicada on the back of the left hand. The wound healed by first intention, and the next morning there was only a black clot *about the size of a pin's head*, to mark its place, with scarcely any swelling.

of the beak of a Cicada will be more serious to some persons than to others. That there is no poison gland attached to this beak is no argument against its stinging power, for several true bugs are known to produce severe stings by their beaks, while the hairs and spines of some caterpillars have a similar power.

THE INJURY WHICH CICADAS CAUSE TO FRUIT TREES.—REMEDIES.

While living under ground they have been accused of killing pear trees, and more especially by Miss Margaretta H. Morris, in accounts of them published in 1846. The late Dr. Smith, of Baltimore, however, who made extensive observations, denied their being capable of such injury. He says:

"The larva obtains its food from the small vegetable radicels that everywhere pervade the fertile earth. It takes its food from the surface of these roots, consisting of the moist exudation (like animal perspiration), for which purpose its rostrum or snout is provided with three exceedingly delicate capillaries or hairs, which project from the tip of the snout and sweep over the surface, gathering up the minute drops of moisture. This is its only food. The mode of taking it can be seen by a good glass."—*In Prairie Farmer, December*, 1851.

The fact that they will rise from land which has been cleared of timber, cultivated, and even built upon for over a dozen years, would seem to contravene Miss Morris's statement, while their long subterranean existence precludes the necessity of rapid suction. It is also quite certain that they rarely kill trees, or we should oftener hear of it, and I have captured a gigantic but unnamed species of Cicada on the plains of Colorado, 50 miles from any tree, other than a few scattering willows.

The truth of the matter seems to be, that while they do puncture and derive nourishment from the roots of trees, they rarely if ever produce in this way any serious injury. This may be due to the fact of their slow development, and the necessarily small amount of nourishment taken at any one time. While I have not been able to prove, as asserted by Dr. Smith, that the bristles at the tip of the proboscideal sheath or labium are ever used as vehicles for nourishment, it is true that the larva is far more often found in a cavity away from any root whatever, than it is fastened to roots. Yet, often in digging for and studying this insect in its larva state, since my 1868 article was written, I have found the larvæ with beaks inserted; in fact they will frequently hang by the beak after they are dug up, and the rootlets of our forest trees, where Cicadas abound, show scars and often slight swellings such as one might expect from the punctures.

In the perfect state, however, the female is capable of doing great injury to trees by hacking up their twigs, in the process of ovipositing, and although their injury in the forest is not generally felt, it is a very different thing in our orchards, and especially in the nursery.

The following editorial from the old *Valley Farmer* of November, 1855, will show how serious the injury may sometimes be:

"We planted an orchard of the best varieties of apple trees last spring. We had taken particular pains, not only in selecting the best varieties, but in planting the trees, and hoped in a few years to partake of the fruit. But our hopes were destined to be blasted. The locusts during the summer destroyed nearly all of them; not one in six is living. To look at them one would think that some person had been drawing the teeth of a saw over the bark of every tree."

It also appears that in some instances they injure trees by the insertion of their beaks for nourishment, for Mr. Gustavus Pauls, of Eureka, had a young apricot tree which was so thoroughly punctured in this manner that he took a gallon of coagulated sap from it, and he attributes the death of some of his trees to this cause. I am convinced, however, that injury of this kind is comparatively rare.

On June 13, 1868, I was sent for by four different parties in Saint Louis County, who wished me to try and save their trees from the ruinous work of these Cicadas, which had by this time begun to deposit their eggs in earnest. I found that when the wind was high they could, by its aid, be driven to some extent, but that without its aid they could not be driven at all, as, when started, they are just as likely to fly behind as before you. I tried lye, whitewash, and sulphur, air-slacked lime, and finally carbolic acid, and found that none of these mixtures would affect them. Indeed, after experiments involving about $200, I am convinced that there is no available way of entirely preventing this ruinous work when they once commence to oviposit. The nursery of Mr. Stephen Partridge, a few miles west of Saint Louis, which is surrounded on all sides by timber, was more seriously injured than any other which I saw, and he lost many hundred dollars' worth of apple, peach, and pear stock. They also punctured his grape-vines very freely, preferring the Clinton and Taylor among varieties. By having all hands turn out early in the morning, and between 6 and 7 o'clock in the evening, while the insects hung listlessly to the branches, he succeeded in crushing thousands of them, and thus saved parts of his nursery from total ruin. But it becomes a hopeless task to try to stay their disastrous work when once they have acquired full power of flight; though, while in their feeble and helpless condition, as they leave the ground, they can not only be destroyed to far greater advantage by human agency, but hogs and poultry of all kinds eagerly devour them. There were, it is true, many accounts afloat in 1868 of hogs being poisoned by them, and, though it is not impossible that one was occasionally killed by over-glutting,* such cases were very rare indeed.

* Mr. T. R. Allen, of Allenton, informs me that during years when the Army Worm (*Leucania unipuncta*, Haw.) occurred in such swarms, hogs and chickens feasted on them to such an extent that the former frequently died, while the latter laid eggs in which the parts naturally white would be entirely green when cooked.

From the foregoing, the importance of knowing beforehand when to expect them becomes apparent, and the following chronological statement will not only prove of scientific interest but of practical value.

CHRONOLOGICAL HISTORY OF THE PERIODICAL CICADA, WITH DATES OF THE FUTURE APPEARANCE OF ALL WELL-ASCERTAINED BROODS THROUGHOUT THE COUNTRY.

As the facts in reference to the existence of a 13-year brood, recorded by Dr. D. L. Phares, in the Woodville (Miss.) *Republican*, and already referred to, were unknown to naturalists generally, and had remained unnoticed and unrecorded in natural history publications, it is only since the year 1868 that a number of these 13-year broods have been fully established. In that year I published the account of twenty-two distinct broods, including all the information that I could obtain at the time both as to 17-year and 13-year broods. The mass of material from which the generalizations were made would have been tedious and voluminous, if given in detail, and was necessarily omitted. The following chronology includes such additional data as I have been able to obtain in the intervening seventeen years.

But little increase in our knowledge as to the distribution of the different broods has been made, so that the chronology remains essentially the same. I have collected during that time, from correspondents and otherwise, numerous additional facts, but most of them, and among them the most trustworthy, relate to broods that were already well known; while of the smaller broods, and especially of those which are in need of confirmation, the additional data are extremely scanty. It should not be inferred, however, that those broods which have not been confirmed, are necessarily invalid; because the additional data have been obtained chiefly when I have made some effort in that direction, while some years, owing to absence from the country or other causes, I have neglected to make inquiry.

I shall therefore be very glad to receive from correspondents as full information, and from as many localities as possible, not only anent the two broods occurring this year, but any of the other broods mentioned in this chronology.

The passages in small type are in each case quoted from the work of 1868, with the exception of the headings, in which the two dates given are made to include the last and the next future appearance of the different broods.

While the discovery of the 13 year broods dispelled much of the fog in which this chronology had hitherto been wrapped, it at the same time rendered a complete and lucid exposition of that chronology extremely difficult. The northern boundary line of the 13-year broods is

about latitude 38°, but in Illinois one of them ascends between two and three degrees above this line, while the 17-year broods descend below it in several places, the two races sometimes occurring in the Carolinas. Thus the two races sometimes occupy the same territory; while two broods of the same race, appearing in different years, may also overlap one another, as in the instance given in the account of Brood XXII, in Virginia, where the "locusts" appear every eighth and ninth year. In order to make the subject as clear as possible, and to facilitate references, I have retained the numbering of the different broods given in 1868 in accordance with the sequence of their appearance from and after that date.

BROOD I.—*Septendecim*—1869, 1886.

In the year 1869, and at intervals of seventeen years thereafter, they will, in all probability, appear in the valley of the Connecticut River. According to Dr. Asa Fitch (N. Y. Rep., I, p. 40), they appeared there in 1818 and 1835, and according to Dr. Smith, they occurred in Franklin, Bristol, and Hampshire Counties, Massachusetts, in 1767, 1784, 1801, 1818, 1835, and 1852.

1869.—The genuineness of this brood was fully established in 1869, as its appearance in Connecticut that year was recorded by several different journals (*Amer. Entomologist*, I, p. 244), and in Massachusetts by a recent communication to the publishers of the *Scientific American* from Mr. Guilford H. Hathaway, of Fall River. He observed the Cicadas at Freetown, near Fall River, in the years 1818, 1835, 1852, and 1869, and adds: "In 1818 they were very numerous; in 1852 still less; and in 1869 they were quite scattering in comparison with 1818."

BROOD II.—*Tredecim*—1882, 1895.

In the year 1869 they will, in all probability, appear in Georgia, in Habersham, Rabun ?, Muscogee, Jasper, Greene, Washington, and adjacent counties, having appeared there in 1843 and 1856, according to Dr. Smith.

1869.—True to time, this brood appeared in great numbers, in 1869, in the northwestern part of Georgia, as I was informed by Mr. A. R. McCutchen, of Lafayette, Walker County, in that State. There is a great deal of evidence, however, which goes to show that it is the 17-year Brood XXII which occurs in the northeastern counties, and Mr. George P. Kollock, of Clarksville, Habersham County, wrote that the "locusts" were not there in 1869, but that they swarmed in 1868 and 1851. This 17-year brood seems to confirm Dr. Fitch's statement (N. Y. Report, I, p. 40) regarding the extent of his fourth brood, and it is further confirmed by the testimony of Mr. D. C. Sutton, of Lafayette, Ga., who wrote me on June 30, 1874, that "the 17-year brood of Habersham and the northeastern counties occurred in 1868, simultaneously with the 13-year brood [XVIII] of Walker County, and the northwestern part of the State.

The extent of this Brood II must therefore be limited. Habersham County must be stricken out, and no doubt Rabun also, while Walker and the adjacent northwestern counties should be added.

1882.—For the year 1882 I failed to get any further information about this brood.

BROOD III.—*Septendecim*—1870, 1887.

In the year 1870, and at intervals of seventeen years thereafter, they will, in all probability, appear in what is known as the "Kreutz Creek Valley," in York County, Pennsylvania, and possibly in Vinton County, Ohio, and Jo Daviess County, Illinois. Mr. S. S. Rathvon, of Lancaster, Pa., speaking of this brood, says: "Lancaster County is bounded on the southwest by the Susquehanna River, dividing it from the county of York, along the northeastern margin of which there is a mountain range, sloping down to the river. Along that slope Cicadas were abundant the present season (1868—Brood XXII). But on the southwest side of the range, in what is known as the Kreutz Creek Valley, there were none. They appeared last in this valley in 1853, and previous to that year at intervals of seventeen years from time immemorial." Dr. Smith records their appearance in 1853, both in Vinton County, Ohio, and Jo Daviess County, Illinois.

1870.—From all that I can learn, this brood is invalid, and has no existence. Mr. Rathvon failed to record its appearance in 1870 in the Kreutz Creek Valley, and the Rev. Dr. J. G. Morris, of Baltimore, Md., writes positively that it did not appear. He says: "Our Lancaster friend, Rathvon, was a little mistaken in presuming that this would be the year of the appearance of the Cicada in Kreutz Creek Valley, York County, Pennsylvania. I have made diligent inquiry of persons familiar with that district, and they report no locusts. Now, it may be that he gives that title to a district different from that which I know by that name (for I was born in that vicinity), but the Kreutz Creek Valley, 7 or 8 miles east of York, and bordering on the Susquehanna, was not visited this year by this singular Cicada."

I likewise failed to hear of the "locusts" either in Vinton County, Ohio, or in Jo Daviess County, Illinois, and as all three of the localities are restricted and widely separated, and as those in Illinois and Pennsylvania are within the range of Brood V, which occurs one year later, the insects recorded to have appeared in the localities named in 1853 were most likely precursors only of the more extensive Brood V.

BROOD IV.—*Tredecim*—1883, 1896.

In the year 1870, being the same as the preceding, they will, in all probability, appear in Jackson, Gadsden, and Washington Counties, Florida, having appeared there, according to Dr. Smith, in 1844 and 1857.

1870.—The appearance was confirmed in 1870, and, as the following communication will show, the brood extends even into Alabama, Mississippi, and Tennessee:

DEAR SIR: The 13-year brood of the Periodical Cicada, mentioned in your first Missouri report (your Brood IV), appeared, according to prediction, in northwestern

Florida this year, extending northward over Alabama and a good portion of eastern Mississippi, and into Tennessee as high as this point. I think I wrote you when they were here. They were not in great numbers at any point. I was at Mobile at the time of their appearance there, and found them singing quite merrily in the woods below the city.

J. PARISH STELLE.

SAVANNAH, TENN., *September* 2, 1870.

1883.—I received no reports for this year, but, if Mr. Stelle's word is to be depended on, there cannot be much doubt that this brood is well established, though it may not appear in great numbers at any place.

BROOD V.—*Septendecim*—1871, 1888.

In the year 1871, and at intervals of seventeen years thereafter, they will, in all probability, appear around the head of Lake Michigan, extending as far east as the middle of the State of Michigan and west an unknown distance into Iowa. Also in Walworth County and other portions of southern Wisconsin, and southward into Illinois. This brood is equal to Dr. Fitch's sixth. It extends all over northern Illinois and as far south as Edgar County, and its appearance in 1837 and 1854 is well and thoroughly recorded. In Champaign County, Illinois, it overlaps Brood XVIII, or the southern Illinois *tredecim* brood, while it also interlocks with Brood XIII (*septendecim*) in the same county.

They will also appear in the same years in the southeast by eastern part of Lancaster County, Pennsylvania, in what is called the "Pequea Valley," having appeared there in vast numbers in 1854.

The earliest known record we have of the appearance of Periodical Cicadas is in Morton's "Memorial," in which it is stated that they appeared at Plymouth, Plymouth County, Massachusetts, in the year 1633. Now, according to that date, one might be led to suppose that this recorded brood of Morton's belonged to this Brood V, as exactly fourteen periods of seventeen years will have elapsed between 1633 and 1871; but, strange to say, we have no other records of his brood than that in the "Memorial," whereas there are abundant records of their appearing one year later in the same locality, ever since 1787. There is, therefore, good reason to believe that the visit recorded by Morton was a premature one, and that it was properly due in 1634. I have therefore placed it in Brood VIII, and have little doubt but that if records could be found these would prove the Cicadas to have appeared in 1651, 1668, 1685, 1702, 1719, 1736, 1753, and 1770. as they did in 1787, 1804, 1821, 1838, and 1855.

1871.—Throughout the country mentioned in the first paragraph, the woods, orchards, corn-fields, and even meadows, were vocal with the shrill songs of these 17-year visitors. I was absent during the time of their appearance, but through the kindness of Dr. LeBaron, Mr. Suel Foster, of Muscatine, Iowa, Mr. H. H. McAfee, of the Wisconsin University, and several other correspondents, I am enabled to fix more precisely the northern, southern, and western boundaries of this brood. Thus, in Wisconsin we may draw a line from Milwaukee on the east, gradually southward to the middle of the southern line of Waukesha County, then making a sudden dip to the center of Walworth County, and rising again a little above the southern line of Jefferson County; then falling a little below Dane; then rising from the southwest corner of Dane to the northwest corner of Iowa County, and from thence along

the Wisconsin River to its mouth. There seems also to be a detached branch commencing about the middle of the northern part of Iowa County and running across the Wisconsin River into Sauk County. Incidentally with his studies on Brood XIII, Prof. C. E. Bessey, of Ames, Iowa, was able in 1878 to define the boundary of this Brood V of 1871, and to illustrate its extent in his State by a map published in the *Iowa Weather Bulletin* for November, 1878. The brood occupies nearly the whole eastern third of the State, not reaching, however, the southeastern corner and being limited toward the west by a line drawn from Mitchell County to a point on the Mississippi River somewhat south of the mouth of the Iowa River. In its southeastern portion this brood overlaps, therefore, Brood XIII. In Illinois the boundary line, in a general way, may be drawn from the northwest portion of Mercer County, southeast to the Illinois River at Peoria, west along the Toledo, Wabash and Western Railroad. There seem to be detachments extending farther south, especially in the eastern portion of the State, and they occurred as far south as Shelby County. In Indiana the line is not well defined, but includes the extreme northwest counties, extending as far south as the Kankakee River. In Michigan it does not extend north as far as Saint Joseph on Lake Michigan.

As this insect can only appear in districts which were timbered or planted to orchard seventeen years ago, it follows that in such an extensive prairie country as that within the limits indicated, the brood must be very much detached and scattered.

The insects did not appear in the Pequea Valley, in Lancaster County, Pennsylvania; at least I have been unable to get any authentic record of the fact.

From all I can learn, no Cicadas appeared at Plymouth, Mass., a fact which corroborates the view expressed in 1868, that the visit recorded by Morton in 1633 was a premature one, and that it was due in 1634.

The southern boundary of this brood in Illinois needs further definition. Mr. A. C. Hammond, of Warsaw, Hancock County, wrote me that in 1871 it did not occur at Warsaw, and the same statement was made to me by Mr. M. L. Dunlap in regard to the vicinity of Champaign.

Mr. S. S. Rathvon, of Lancaster, Pa., subsequently (May 17, 1872) informed me by letter that he had also failed in 1871 to hear anything of this brood in Pennsylvania.

Belated individuals of this brood were reported to me by Mr. E. S. L. Richardson, from Oswego, Kendall County, Illinois, on June 20, 1872, who also states at the same time that the Cicadas were there in 1837, 1854, and 1871.

Brood VI.—*Tredecim*—1884, 1897.

In the year 1871, being the same year as the preceding, and at intervals of thirteen years thereafter, they will, in all probability, appear in the extreme southwestern

corner of Mississippi and in the adjoining part of Louisiana. Dr. D. L. Phares, of Newtonia (near Woodville), Miss., says that in 1858 they extended over most of Wilkinson and part of Amite Counties, Mississippi, and East and West Feliciana, Louisiana. He has himself witnessed the appearance of this brood during the years 1832, 1845, and 1858, while it is distinctly remembered by aged people in his neighborhood as having also appeared there in the years 1806 and 1819. Dr. Smith gives their range from the Mississippi River east to a ridge 45 miles from the river that divides the State north and south, and north and south to the boundaries of the State, recording them as occurring in 1806, 1819, 1832, 1845, and 1858.

1871.—This brood also appeared in 1871, and a few precursors were noticed in 1869, but none in 1870. I quote the following account of it from a letter from Dr. Phares: "A few males began to appear about the 20th of April. Not many of any kind came out till the 7th and 8th of May. On those two days, from 5½ till 8 p. m., or about dark, they came forth from the earth in vast numbers, and in large numbers from that time for ten days more, the last I noticed issuing on the 18th of May, and being mostly of the smaller and sometimes darker-colored individuals. Perhaps three-fourths of those coming up on the 7th and 8th of May were females. They are now (May 22) in full song, and I notice, with others, that when my large bell (412 pounds) is rung, they sing with redoubled fury."

Dr. Phares also sent me a large number of specimens and measurements to show that there is a variation of at least half an inch in the expanse of the wings, and that the small, dark form which has been named *cassinii* is connected with the larger normal form by infinite grades. He is more convinced than ever that the small form cannot be a distinct species, and that there should be no *C. cassinii* recognized; in which opinion I fully concur.

Regarding the possibility that a detachment of this brood exists in southern Illinois (Union County), I refer to my remarks on Brood VII.

In a communication to the *Southern Field and Factory*, August, 1873, Dr. Phares records the appearance of this brood since the year 1806, and defines its extent in Louisiana and Mississippi as follows:

"Their western limit is the Mississippi River, the southern about 8 miles north of Baton Rouge, the eastern about 4 miles west of Greensburgh, the county seat of Saint Helena, and 4 miles west also of Liberty, in Amite County, Mississippi, thus extending from 15 to 50 miles from the Mississippi River, and from the vicinity of the city of Baton Rouge, 108 miles to the northern limit of Claiborne County, Mississippi, perhaps even further. They, therefore, occupy East and West Feliciana, the northern part of East Baton Rouge, the northwest corner of Livingston, and the western part of Saint Helena parishes, Louisiana, and Wilkinson, Adams, Jefferson, Claiborne, and parts of Amite, Franklin, and possibly parts of one or two more counties in Mississippi."

According to Mr. J. W. Merchant (letter dated August 29, 1871), this brood did not appear at Carthage, Miss., which statement confirms the

extent of the brood as given by Dr. Smith and Dr. Phares, Carthage being east of the dividing ridge of the State of Mississippi.

BROOD VII.—*Tredecim*—1872, 1885.

In the year 1872, and at intervals of thirteen years thereafter, they will, in all probability, appear in Jackson County and around Cobden and Jonesborough, in Union County, southern Illinois, in Kansas, Missouri, Georgia, Louisiana, Tennessee, and Mississippi.

According to Mr. Paul Frick, of Jonesborough, they were in Union County, Illinois, in 1858, and he also thinks it was a great year for them *about* 1832. Those of 1858 were probably premature stragglers of the 1859 brood, while Mr. Frick is most likely mistaken as to the year 1832, since the Rev. George W. Ferrell, of Cobden, Union County, witnessed their appearance at that place in 1833, and also in 1846 and 1859; and Cyrus Thomas has also recorded their appearance in 1859 in the fifth report of the Illinois State Agricultural Society, page 458,* while a paragraph in the *Baltimore* (Md.) *Sun* of June 13, 1859, says, "The locusts have made their appearance in 'Egypt,' in southern Illinois, and cover woods and orchards in swarms." This brood not improbably extends westward into Missouri, for several of the old settlers around Eureka, in Saint Louis County, Missouri, recollect it being "locust year" about the time of its last appearance, while Mr. L. D. Votaw, of Eureka, and William Muir, of Fox Creek, Mo., both believe it was exactly nine years from 1868, or in the year 1859. Dr. Smith records it in DeKalb, Gwinnett, and Newton Counties, Georgia, in 1846 and 1859; in the northern part of Tennessee, also, in 1846 and 1859; in the whole eastern portion of Mississippi, from the ridge, which is 45 miles from the river, on the west, to the eastern boundary, in 1820, 1833, 1846, and 1859; in Carroll Parish, Louisiana, in 1859; and in Phillips County, Kansas, in the same year.

By referring to Brood XV, it will be seen that in 1846, or during the first year of the Mexican war, this 13-year brood appeared simultaneously with a 17-year brood in western Pennsylvania and Ohio.

1872.—For this year we have records of the reappearance of this brood from the following localities: In southern Illinois it appeared in Union County, as witnessed by a correspondent of the *Saint Louis Republican*, who writes, on May 31, 1871, from Cobden: "This section of country is quite lively and animated at present, a great portion of the life being supplied by the locust, whose shrill monotone meets and oppresses the ear in all directions. There is no escaping that tiresome tune, and we can only wish, vainly enough, that the noisy insects would introduce some variations into their ceaseless song. During the past week they have been coming out of the ground in myriads, and the trees are loaded with them, as they deposit their eggs in the bark of the young and tender branches." Another correspondent from "Egypt," of the same county, states that the locusts have appeared there true to prediction; that the woods are now ringing with their song, and that he knows of the appearance of the brood in 1846 and 1859. Among my own correspondents, Mr. Parker Earle (letter dated May 25, 1872) and Mr. S. H. Beckwith, of South Pass, stated that they abounded at Cobden, Union

* If Mr. Paul Frick is correct, the brood he has witnessed may possibly be a detachment of the Mississippi and Louisiana Brood VI; in which case the Cicadas appear for two consecutive years in Union County, Illinois, as they do (see Broods XIII and XIV) in central Ohio and portions of northwestern Missouri.

County, the latter adding that he caught about a dozen precursors in 1871. Mr. J. B. Miller, residing at Anna, in the same county, wrote (May 17, 1872), "they are here in hosts, according to prediction," and that he can trace the brood back to 1846. Finally, Mr. J. R. Muhleman (June 20, 1872) stated that a few stragglers of this brood extend as far north as Woodburn, in Macoupin County.

In Missouri the existence of this brood was fully established in 1872, though the exact limits of its range still remain to be defined. From Saint Louis County, Mr. H. J. Schulte, of Carondelet (letter June 10, 1872), reported them as being generally distributed throughout his section of the county, and on June 7 I noticed quite a number of Cicadas near Eureka and a few around Kirkwood. The only other place in that State from which this brood was reported is Rocheport, in the extreme southwestern corner of Boone County. Mr. M. P. Lientz, writing from that place on June 3, 1872, says that the Cicadas were thick enough there to make the woods noisy. Boone County is considerably west of Saint Louis County, but nearly in the same latitude.

Nothing was heard from Kansas to confirm or contradict Dr. Smith's statement regarding the occurrence of this brood in Phillips County.

From Tennessee the brood was reported in Madison County. The *Jackson Whig and Tribune* of May 25, stated that "they are doing their level best to make the woods north of the town vocal with their million voices;" and in the extreme southwestern corner, as Mr. W. Phillips, of the University of Mississippi, wrote me on January 22, 1873, they were below and about Memphis in their usual quantities.

In Mississippi they were, according to Mr. J. P. Stelle, swarming at Hazlehurst, Copiah County. According to Dr. George Little (as communicated to me by Mr. W. Phillips), they appeared at Oxford, Miss., in 1859 as well as 1872.

That this brood occurs in Arkansas seems to be proved by a communication of Mr. J. W. Howard, of Flat Bayou, to the *Phillips Southern Farmer*, October, 1872, stating that 1872 was the locust year in his section of the country.

Neither from Louisiana nor from Georgia did I receive any information in 1872 concerning this brood.

The existence of this brood has thus been verified in the parts of Illinois, Missouri, Tennessee, and Mississippi indicated above, and Arkansas has to be added thereto, while the other localities (Kansas, Georgia, and perhaps also Louisiana) require further verification this year (1885).

Brood VIII.—*Septendecim*—1872, 1889.

In the year 1872, being the same year as the preceding, and at intervals of seventeen years thereafter, they will, in all probability, appear in the southeastern part of Massachusetts; across Long Island, along the Atlantic coast to Chesapeake Bay, and up the Susquehanna at least as far as to Carlisle in Pennsylvania; also in Kentucky, at Kanawha in West Virginia, and Gallipolis, Ohio, on the Ohio River. This is the

brood referred to in Brood V, and which there is every reason to believe is the one recorded by Morton in his "Memorial," as occurring in 1633.

Dr. Fitch, in the account of his third brood (New York Report, I, page 39), says: "The third brood appears to have the most extensive geographical range. From the southeastern part of Massachusetts it extends across Long Island and along the Atlantic coast to Chesapeake Bay, and up the Susquehanna at least as far as to Carlisle in Pennsylvania; and it probably reaches continuously west to the Ohio, for it occupies the valley of that river at Kanawha in [West] Virginia, and onwards to its mouth, and down the valley of the Mississippi probably to its month, and up its tributaries, west, into the Indian Territory. This brood has appeared the present year, 1855, and I have received specimens from Long Island, from South Illinois, and the Creek Indian country west of Arkansas," &c.

There is every reason to believe that Dr. Fitch, in this account, has confounded this *septendecim* Brood VIII, with the great *tredecim* Brood XVIII, for it so happened that they both occurred simultaneously in 1855, but the exact dividing line of these two broods is not so easily ascertained. Certainly, after reaching the Ohio River, the *septendecim* brood extends beyond Gallipolis, Ohio, for Professor Potter, in his "Notes on the Cicada decem septima," records their appearance at that place in 1821; and Dr. Smith records their appearance at Frankfort, Lexington, and Flemingsburg, Ky., in 1838 and 1855. But I strongly incline to believe that well nigh the rest of the territory mentioned by Dr. Fitch was occupied by the *tredecim* brood, the reasons for which belief will be found in the account of Brood XVIII.

Cicadas also appeared in Buncombe and McDowell Counties, North Carolina, in 1855, but until they appear there again it will be impossible to say, positively, whether they belong to this *septendecim* Brood VIII, or to the *tredecim* Brood XVIII.

1872.—The reports I was able to obtain for this year are as follows:

Mr. F. G. Sanborn wrote us on January, 1873, that he could find no trace of the appearance of this brood in Massachusetts in 1872. Dr. Packard, however (*Amer. Nat.*, VII, p. 536), says they appeared in the southerly part of the State. Moreover, the existence of this brood in southeastern Massachusetts has been fully confirmed by the following letter we received on January 17, 1873, from Mr. W. C. Fish, East Falmouth, Mass.:

"The seventeen-year locusts were very abundant here the past season, and did much damage in the woodlands, particularly among the young oak sprouts of a few years' growth, and in some of these localities where there were no large trees they completely riddled the huckleberry bushes. Between here and Sandwich there is a continuous tract of woodland. Sandwich is 15 miles north of us. This tract of woodland extends through a large portion of Plymouth County. I know that the locusts occurred through nearly all of this tract from Plymouth south and east through the towns of Sandwich and Falmouth, and east through the towns of Barnstable and Yarmouth. I do not know whether the brood extends further east down the Cape or not. It seems a little singular that when it occurs in such abundance here on the shore of Vineyard Sound, that they should come another year on the island of Martha's Vineyard so near us."

In New York the appearance of this brood in 1872, on Long Island, seems to be confirmed, as Mr. S. S. Rathvon wrote us (July 16, 1872) that

he saw a paragraph in the *U. S. Gazette* which reported the Cicadas to be in abundance on that island.

From Pennsylvania Mr. Rathvon sent us (July 16, 1872) a diagram illustrating the extent of the brood as observed by him in 1872, viz: Franklin, Adams, York, Lancaster, and Chester Counties, the Cicadas being mostly confined to woody portions along streams.

In Kentucky the brood was observed in the northwestern portion of the State, extending, according to the late Mr. V. T. Chambers, into the central portion beyond Lexington. According to newspaper items, the Cicadas were abundant in Richmond, Madison County, and Mr. T. W. Gordon, of Georgetown, Ohio, reported them from Maysville, Ky. The same gentleman stated also that his son caught several at Maysville in 1871, and these were no doubt forerunners of this brood.

All reports we received from Ohio came from the southwestern corner of the State. On May 25 Dr. John A. Warder brought me specimens from Cleves, Hamilton County. Mr. C. L. James, of Waynesville, Warren County, said, in a letter of June 10, that "they are there in full force, but not so many as in 1855; that fungus disease attacked the females by thousands. The brood in 1838 exceeded anything he ever saw." In Brown County the brood was observed by Mr. T. W. Gordon, of Georgetown, and Mr. S. Shepherd, of Hennepin, Ill., wrote me, on November 22, 1876, that he observed the brood in Brown County in 1804 and 1821. An item of the Prairie Farmer Record, dated May 26, 1872, and signed "D. M.," states "that the 17-year locusts are on hand in Clinton County." Finally Mr. Chambers (letter June 17, 1872) stated that the Cicadas extended some miles northeast from Cincinnati. Thus the brood is now fully confirmed in Ohio, though its eastward extension in that State still remains rather indefinite.

The isolated localities in North Carolina mentioned in the above quotation from my first Missouri report were not confirmed in 1872, which is an additional proof that the Cicadas which appeared there in 1855 belong to Brood XVIII. Nor did I get any news from the isolated locality in West Virginia mentioned above, though an eastward extension of the brood through eastern Kentucky to southern West Virginia is by no means impossible.

The most interesting result of the observations in 1872 is, however, the fact that this brood has a much greater westward extension than was previously supposed. In Indiana, Mr. O. S. Westcott, a well-known entomologist, found the Cicadas all along the Evansville and Crawfordsville Railroad, extending from Evansville certainly as far as Terre Haute, but not reaching east as far as Shoals, in Martin County. From Illinois another trustworthy observer, Mr. S. Shepherd, formerly residing in Brown County, Ohio, but having afterward moved to Hennepin, Putnam County, Illinois, wrote me on November 22, 1876, that he saw this brood at his present residence in 1838 and 1855. This occurrence of the brood in Illinois was also confirmed by a newspaper item from

the *Prairie Farmer*, briefly recording the appearance of Cicadas in McLean County.

Upon reviewing the localities of this brood as now ascertained we find that they represent a comparatively narrow curve with the ends pointing northward. The northeastern extremity commences in southeastern Massachusetts; thence the line goes south to Long Island; thence west through Pennsylvania, southern Ohio, and northern Kentucky to southern Indiana; thence again bending northward and reaching central Illinois with its northwestern extremity. This large belt is, however, by no means entirely occupied by the brood, and two large, compact central areas are plainly distinguished, one being in southeastern Pennsylvania, the other in northern Kentucky and southwestern Ohio. To the west there are two detached areas, one in southwestern Indiana, the other in central Illinois, while to the east there are again two detached areas, one on Long Island and the other in southeastern Massachusetts.

BROOD IX.—*Septendecim* (?)—1874, 1891.

In the year 1874, and at intervals of seventeen years thereafter, they will probably occur in southeastern Nebraska.

The occurrence of this brood was communicated to me by Mr. Clarke Irvine, of Oregon, Holt County, Mo. The brood is most likely confined to the eastern or timbered portion of the State, and I judge it to be *septendecim*, from the fact that the latitude is rather more northerly than *tredecim* is known to occur.

1874.—Whether this brood is a 17-year or 13-year one still remains somewhat doubtful, with the probability in favor of the former; but its existence and, at the same time, its extent westward to Colorado seem to be confirmed by a letter from Mr. J. H. Rice, of Gold Hill, Boulder County, Colorado, dated July 31, 1874, stating that the Cicadas occurred there in 1874, but not very abundantly. While it is true that this locality in Colorado is widely detached from that in southeastern Nebraska, yet we do not doubt that the Cicadas of both localities belong to the same brood. In these less timbered western States the broods must naturally be very much broken up, and appear in scattered localities and not in compact regions, as in the timbered States.

In this connection I would mention that on May 17, 1872, Mr. J. B. Miller informed me of a brood between the headwaters of the Smoke Hill River and Denver City, Colorado, in 1858. "Their work was plainly visible on a grove of young pitch pines." If these Cicadas were not stragglers of this Brood IX, but belong to some other brood, they would be difficult to place among the broods here enumerated. If they are a 13-year brood they could only belong to our Brood VI, which is extremely improbable. Moreover, it is not likely that central Colorado possesses a 13-year brood. If they belong to the 17-year race they would indicate a brood not yet enumerated and to be placed between my Broods IX and X. Although I have no reason to doubt the correctness of Mr. Miller's statement, yet it must be remembered

that errors in referring old observations to a particular year are easily made. For this reason I am unwilling to establish a new brood on the strength of this single testimony, and prefer to attach this locality to this Brood IX until the contrary has been proven. Neither in the year 1871 nor 1875 did I learn anything of the appearance of Cicadas in the locality mentioned by Mr. Miller.

BROOD X.—*Tredecim*—1875, 1888.

In the year 1875, and at intervals of thirteen years thereafter, they will most likely occur in different parts of Texas. According to Dr. Smith they appeared in vast numbers in some parts of Texas in 1849, though he was not able to get any particulars.

1875.—The year 1875 did not furnish any information regarding this brood, the existence of which is, therefore, solely based upon Dr. Smith's statement. That Dr. Smith himself was unable to obtain definite localities for this brood might justly be regarded as a suspicious circumstance, and should the year 1888, in which the reappearance of the Cicadas may be looked for, also fail to confirm this brood, it would be best to strike it entirely from the list of the well-established broods.*

BROOD XI.—*Septendecim*—1876, 1893.

In the year 1876, and at intervals of 17 years thereafter, they will, in all probability, appear in parts of North Carolina, Virginia, Maryland, Illinois, and Indiana. According to Dr. Smith they appeared from Raleigh, N. C., to near Petersburg, Va., in 1842 and 1859; in Rowan, Davie, Cabarras, and Iredell Counties, in the same State, in 1825, 1842, and 1859; in the valley of Virginia, as far as the Blue Ridge on the east, the Potomac River on the north, the Tennessee and North Carolina lines on the south, and for several counties west, in 1808, 1842, and 1859; in the south part of Saint Mary's County, Maryland, dividing the county about midway east and west, in 1825, 1842, and 1859; in Illinois, about Alton, in 1842 and 1859; and in Sullivan and Knox Counties, Indiana, in 1842 and 1859.

1876.—Although this brood is thus well recorded in former years from many sections of the country, I received but few data in reference to it in 1876—a fact due to preoccupation with other matters. A correspondent at Lexington, Va., recorded their appearance at his place in the

* The only information which might possibly be referred to this brood is contained in a letter we received July 1, 1875, from Dr. D. L. Phares, and which reads as follows:

"About the 10th of June [1875], coming up the Mississippi River from New Orleans, at Bayou Sara, I heard of a family of Cicadas in West Feliciana Parish, Louisiana, near the river and south of Bayou Sara. I requested a gentleman to get what history he could of them and send me specimens. I have received nothing from him except the specimens I send herewith—all dwarfs, or perhaps a distinct variety."

It will be difficult to attach these specimens, either as precursors or belated specimens, to any one of the recorded broods, unless to this Brood X, of which they may possibly be the easternmost outpost. Still, as this isolated family of Cicadas has been observed east of the Mississippi, and therefore in a locality widely separated from Texas, nothing that is certain can be said regarding the connection of this swarm with Brood X.

New York Weekly Tribune June 24, 1876, and at the same time sent me a few specimens.

In the *American Entomologist*, vol. III, p. 77, the late Mr. V. T. Chambers stated that he found the Cicada in Cheyenne Cañon, Colo., in June, 1876, and this statement very probably indicates a detached outpost of this seventeen-year brood XI, since, as I have already said, it is not probable that northern and central Colorado possess a seventeen-year brood.

BROOD XII.—*Septendecim*—1877, 1894.

In the year 1877, and at intervals of 17 years thereafter, they will, in all probability, appear in the vicinity of Schuylerville and Fort Miller, in New York; thence along both sides of the Hudson to its mouth, where they extend, at least, to New Haven, in Connecticut, and west across the north part of New Jersey and into Pennsylvania; also in Dearborn County, Indiana; Kalamazoo, Mich.; in Pennsylvania, North Carolina, Virginia, and Maryland.

This brood is recorded by Professor Potter as having occurred at North Haven, Conn., in 1724, 1741, 1758, 1792, 1809, and 1826. It was also recorded by the same writer as having occurred in 1826 in Middlesex County, New Jersey, and by Dr. Fitch as having occurred in 1843 throughout the whole country mentioned above. In 1860, again, it was spoken of in the old series of the *Prairie Farmer* (vol. 22, p. 119) as having occurred that year in New Jersey, and Dr. Smith records it throughout the whole State in 1775, 1792, 1809, 1826, and 1843. Mr. James Angus, of West Farms, Westchester County, New York, has himself witnessed its recurrence in the years 1843 and 1860.

In Pennsylvania, Mr. Rathvon found a few individuals in 1860, and Dr. Smith says it extends from the Susquehanna to the Delaware River, bounded by Peter's Mountain on the south. In Virginia it occurred from the south part of Loudon County to the Roanoke River, and from the Blue Ridge to the Potomac, in 1826, 1843, and 1860; in Maryland from Anne Arundel County to the north part of Saint Mary's, and from the Potomac to Chesapeake Bay, in 1809, 1826, 1843, and 1860; in Rockingham, Stokes, Guilford, Rowan, Surry, and adjacent counties, North Carolina, in 1792, 1809, 1826, and 1843; in Dearborn County, Indiana, in 1843 and in 1860; and in Kalamazoo, Mich., during the same years.

1877.—This is one of the best recorded broods; and as it appears in the immediate vicinity of New York, Brooklyn, Jersey City, and other great centers of population, the records for the year 1877 are abundant in newspaper articles as well as in letters from correspondents. The reports from New York State agree that in 1877 the Cicadas were extremely abundant on Staten Island, much less so on Long Island, while there were none within the city of New York.

Along both sides of the Hudson River they were observed at many points, reaching so far north as in the vicinity of Troy in Rensselaer County, thus exactly confirming the extent of the brood as given above.

In Connecticut they were observed by Mr. William H. Patton, who wrote me as follows on July 3, 1877: "May 12th, large numbers of pupæ were found under stones in woods near Meriden, Conn.; May 27th, I saw the first perfect insect here in New Haven, and can find no knowledge of its earlier appearance, although I heard rumors of its appearance before that date. At the present writing they are still plentiful in the limited localities which they frequent."

In New Jersey they were seen and heard at many points in Hudson, Bergen, Essex, and Middlesex Counties, and much less frequently in other parts of the State; but Mr. A. E. Newton, of Ancora, in Camden County, observed them near his place, and wrote me on June 25, 1877: "From what I hear from other localities I judge that southern New Jersey generally, as well as northern, is subject to the visitation. They are doing little damage." Thus Dr. Smith's statement that they occur throughout the State seems to be confirmed.

In Pennsylvania, according to a communication to the *New York Weekly Sun* from Milford, dated June 11, they appeared in immense numbers in Pike County, having been much less numerous in 1860.* No news came to me from the southern portion of the State, where this brood is evidently not numerous.

I received no information concerning the localities above mentioned in Indiana and Michigan in 1877, but the records from Virginia are again numerous. Thus, Mr. William Hunter, Accokeek Mills, near Mount Vernon, Fairfax County, wrote, on June 4, 1877, that the Cicadas were thick near his mill and in his neighborhood, as they were also in 1860. "They are most plentiful on the hills, but some exist also in the valleys, and there are some localities where none are found, although surrounded on all sides by the infested neighborhoods." Mrs. Annie Noyes Higgs briefly announced the appearance of the Cicadas, beginning May 27, near Glendower, in Albemarle County; Mr. T. G. Legatt, of Lynchburg (letter of June 8, 1877), records the Cicadas from the vicinity of Lynchburg and from the counties immediately adjoining the city; and Mr. G. Underhill announced, in a card of June 4, 1877, their appearance at Fork Union, Fluvanna County. The brood is thus more widely distributed in Virginia than would appear from my record of 1868, and there is but little doubt that it extends to the southern limits of the State.

From Maryland I have a record only from Charles County, by Mr. William Hunter, who stated that the Cicadas were much less numerous there than in the hilly portions of Fairfax County, Virginia.

In the District of Columbia this brood was observed by many residents of Washington in 1877, so that the District must be added to the above localities.

Brood XIII.—*Septendecim*—1878, 1895.

In the year 1878, and at intervals of seventeen years thereafter, they will, in all probability, appear along the center of the State of Illinois, all along the southern part of Iowa, and around Saint Joseph, in Buchanan County, in northern Missouri.

The records are abundant of their appearance in 1844 and 1861 all along the southern border of Iowa, and in Mason, Fulton, McDonough, and Champaign Counties, in central Illinois. In 1861 they also occurred in Champaign County, central Ohio, and in Buchanan County, northwestern Missouri; and this brood doubtless occupies, more or less, the whole strip of country between these two points. Their appearance in 1861 was associated with the first year of the rebellion, and Dr. Smith records this brood both in Illinois and Iowa in 1844.

* Professor Leidy (Proc. Ac. Nat. Sc. Phil., 1877, p. 260) briefly records their appearance near Easton, Northampton County.

1878.—The most compact body of this brood appears to be in Iowa, where its appearance in 1878 was carefully studied by Prof. C. E. Bessey, then of the Agricultural College at Ames. He illustrated the region occupied by the Cicadas in 1878 by a map attached to the *Iowa Weather Bulletin* for November, 1878, and treats more fully of the distribution of this and other broods in his State, in an article published in the *American Entomologist*, vol. III, p. 27, the article being also accompanied by a map. Professor Bessey gives there a list of counties in which the Cicadas were observed in 1878, and sums up the result as follows: "Twenty-eight counties were reported as having more or less of the Cicadas in 1878, and they are seen on the map to occupy a large area extending from the southeastern portion of the State northwestward up the Des Moines River. This area includes several counties from which no replies have been received, but in which doubtless the Cicadas appeared; these added to the reported counties make the whole number thirty-three or thirty-four, or say, one-third of the State. A careful calculation shows this area to include from 18,000 to 20,000 square miles. Its northern, or more properly, its northeasterly margin is parallel with the Des Moines River, and distant from it about 50 miles, running from near the city of Muscatine to Hamilton County, when it bends off southwestwardly to Cass County and thence to the State line in Decatur County. That part of the area lying southward, or southwestward of the Des Moines River is considerably broader than that on the northeast, being from 60 to 70 miles in width." In connection with these publications Professor Bessey states that the brood of 1878 was generally less numerous that year than at its preceding appearance in 1861; and, further, that it overlaps the brood of 1871 (Brood V) along the lower course of the Iowa River.

From these well-established data regarding this brood in Iowa one would suppose that it must occupy many of the northernmost counties of Missouri, but neither from that State nor from Illinois did I receive any reports in 1878. The detached locality in central Ohio has also remained without confirmation.

Brood XIV.—*Septendecim*—1879, 1896.

In the year 1879, and at intervals of 17 years thereafter, they will, in all probability appear in the whole of western Missouri, commencing south about Johnson and Saline Counties, and extending in a northwesterly direction to Lawrence and above, in Kansas, south to Arkansas, and west an unknown distance into Kansas; also in central Ohio.

The occurrence of this brood in 1845 and 1862 is well remembered by several of my correspondents and is recorded by Dr. Smith. At Saint Joseph, in Buchanan County, Missouri, Cicadas were not so thick in 1862 as in 1861. Had it been the reverse, or, in other words, had they been more numerous in 1862 than in 1861, I should have been inclined to record the visit of 1861 as but a precursor to this Brood X; but as it is, I believe the two broods are distinct, and that they occur for two consecutive years both in central Ohio and in portions of northwestern Missouri.

This brood has not been traced further east in Missouri than Saline County, and

yet a detachment of it certainly occurs in Ohio, for Mr. Clarke Irvine, of Oregon, Holt County, Missouri, well remembers their occurrence in central Ohio in 1845 and 1862. Though there is no knowledge of the appearance of this Brood XIV in Illinois, yet the fact of its occurring both in Ohio and in northern Missouri, and that, too, but one year after Brood XIII, would indicate that there may have been in times past, at all events, if there is not at the present day, a geographical connection between these two broods.

1879.—This brood was well recorded in 1879 from Missouri and especially Kansas, while reports from other States give it a much wider extension in the trans Mississippi States than was previously recorded.

The reports from Missouri do not add anything new, since they all come from the northwestern portion of the State, where the brood was already by well-established previous visits, and I would only mention that, according to Mrs. Barbara M. Shiesl (letter of June 16, 1879), Saint Joseph belongs to those cities which have had this brood within their limits.

In Kansas the extent of the brood has been studied by our trusted correspondent Mr. Robert Milliken, of Emporia, who wrote me as follows on June 22, 1879: "I have been at some little trouble to inquire regarding the extent of the distribution of the *Cicada septendecim* in this State at the present, and learn that it is general throughout the central counties. I have positive information of their occurrence in Lyon, Morris, Chase, Marion, Greenwood, Coffey, Osage, and Woodson Counties, wherever there are belts of timber." The following reports refer to localities in Kansas not mentioned by Mr. Milliken: Mr. J. Paulsen, Fort Scott, Bourbon County (card of June 16, 1879), states that they were in great numbers at his place, injuring apple trees. From the same county they are reported by Mr. G. C. Willey, of Uniontown (letter of June 20, 1879), stating that the Cicadas are in the timber skirting the streams in his county, and that "their number is beyond the comprehension of man." Mr. J. F. Willard (card of June 20, 1879) briefly recorded them from near Alma, Wabaunsee County, and near Louisville, Pottawatomie County. Mr. M. J. Burdge (card of June 25, 1879) stated that the Cicadas made their appearance in the timber along the streams in Johnson County. Finally, Mr. J. C. Harrun, of Humboldt, Allen County, wrote (June 14, 1879): "There are great numbers of the Cicadas along the Neosho and other rivers, in the timber belts, and a few have found their way to the hedges on the prairies." It will be seen that these localities form a nearly compact region in the eastern third of Kansas, and there can hardly be any doubt that this brood occupies also the extreme northern and southern counties in the same section of the State.

The northernmost point reached by this brood, so far as now established, appears to be Pottawattamie County, Iowa, in which State, according to Prof. C. E. Bessey (*vide* his map in the *Amer. Entom.*, III, p. 27), it occupies the eight counties comprising the southwestern corner of the State.

Across the Missouri River the brood extends into Nebraska, as on June 19, 1879, I received from Mr. D. W. Hershey specimens captured at Nebraska City.

From Arkansas reports for 1879 are wanting, but from trustworthy testimony we have to add Indian Territory and northern Texas to the region occupied by this Brood XIV. From Indian Territory Mr. W. S. Robertson, Muscogee Post-Office, sent me specimens captured near the banks of the Arkansas River, and stated in his letter of June 17, 1879, "that this brood is entirely confined to the river bottoms, whereas another brood appears on the oak and hickory groves on the upland." Unfortunately, Mr. Robertson failed to give any dates for this upland brood, but it may possibly be Brood XVIII. The occurrence of the brood in northeastern Texas is based upon a letter from Mr. S. R. Ludlow, of Valley Creek, Fannin County, dated June 25, 1879, and stating that the Seventeen-year Cicadas made their appearance in the "brush section" of his county about April 20.

Future observations will no doubt add many other locations for this brood in Indian Territory and Arkansas, and thus connect more closely the southernmost point of the brood in Texas with the region occupied in Missouri and Kansas.

Leaving out of consideration the detached locality in central Ohio, which has not been confirmed in 1879, and which is based solely upon the testimony of Mr. Clarke Irvine, we see that this brood occupies a very compact region of the country, its southernmost point being about in the same latitude as that reached by Brood XXII in Northern Georgia.

Brood XV.—*Septendecim*—1880, 1897.

In the year 1880, and at intervals of 17 years thereafter, they will, in all probability, appear from western Pennsylvania to Scioto River east, and down the valley of the Ohio River as far as Lewis County, in Kentucky.

This brood is recorded in Ohio as far back as the year 1812, by "A. M. B.," writing to the *Chicago Tribune*, under date of June 22, 1868. Harris also records its appearance in Ohio in 1829, and they were quite numerous in the center of the same State in 1846, or during the first year of the Mexican war; while Dr. Smith records it in the eastern part of the State, extending over twelve counties west to the Scioto River, and to Sandusky, on Lake Erie, in 1829, 1846, and 1863, and in Lewis County, Kentucky, since 1795. As before stated, this brood occurred in Ohio in 1846, simultaneously with the *tredecim* Brood VII in southern Illinois. Dr. Fitch, in his account of his fifth brood, also records its appearance, and states that it reached to Louisiana. But just as the *septendecim* Brood VIII was confounded with the great *tredecim* Brood XVIII in 1855, so this *septendecim* Brood XV was doubtless also confounded with it in 1829, for they both occurred that year. Had the western country been as thickly settled in 1829 as it was in 1855, the *tredecim* Brood XVIII could undoubtedly have been traced in southern Illinois and Missouri, &c., in the former as it was in the latter year. This belief is furthermore greatly strengthened from our having no other record of the appearance of this *septendecim* brood in Louisiana than Professor Potter's statement that they appeared there in 1829; whereas they have occurred there since 1829 at intervals not of 17 but of 13 years, and were there the present year [1868], as will be seen on referring to Brood XVIII. The dividing line of these two broods (XV and XVIII) is probably the same as with Broods VIII and XVIII.

Since the publication of the above I have received the following interesting communications regarding this brood: Mr. J. H. Niles, of Havana, Huron County, Ohio (letter of June 7, 1877), writing about the distribution of Broods XV and XXII, says: "I am acquainted with two distinct families of the Cicada in northern Ohio. I first saw the great eastern Ohio family [XV], due in 1880, in 1846, and again in 1863; and the small family [XXII], due in 1885, in 1834, again in 1851, and again in 1868. When the Cicada appeared in 1846, the question was raised whether they were partial to any particular geological formation. The result showed that they occupied the conglomerate, the sandstone, and the slatestone formations of eastern Ohio, not the limestone formation of western Ohio. For instance, a line drawn for the western edge of the black slate, from the city of Bucyrus, in Crawford County, and the northwest corner of Huron County and Erie County, to the east of Sandusky Bay, marked correctly the western edge of the Cicada of 1880."*

An important contribution to our knowledge of the extent of this brood was furnished by the following letter from Mr. Luther Haymond, of Clarksburg, Harrison County, West Virginia, dated June 1, 1877: "The Seventeen-year Cicada appeared in this district as follows: On the 12th May, 1795; on the 25th May, 1812; on the 25th May, 1829; on the 15th May, 1846; on the 25th May, 1863. I am not certain as to the extent of this Cicada district, but I think it includes all of West Virginia lying on the west side of the Alleghany Mountains."

1880.—The reappearance of this brood in Pennsylvania and Ohio was generally noted in the papers, without, however, conveying any new or important information. The *New York Weekly Tribune* of June 7, 1880, contains an article commencing, "The seventeen-year locust is filling the hills and rich bottom lands of western Pennsylvania and Virginia with its droning thunder," &c. Since this brood has never been observed east of the Alleghanies, its occurrence in Virginia is extremely improbable, and the author of the article apparently intended to write "West Virginia." Several of my own correspondents reported the brood from Geauga and Lake Counties, Ohio, and Mr. William H. Edwards, of Coalburg, W. Va., wrote that the Cicada had appeared in his section of West Virginia (*Amer. Entom.*, III, p. 170), thus confirming Mr. Haymond's statement given above.

Thus the brood, so far as now ascertained, occupies a very compact area, comprising western Pennsylvania, western West Virginia, the whole eastern half of Ohio, and adjacent portions of northern Kentucky.

There do not seem to be any well-established detached localities for this brood, and the only indication of any such locality is contained in the article by Professor Bessey referred to under Brood XIII (*Amer.*

* The continuation of this letter, relating to Brood XXII, will be found under that brood.

Entom., III, p. 29), where he says: "Mr. Meredith, a member of the senior class of the Agricultural College, and a resident of Taylor County, informs me that there were no Cicadas in that county this year, but that *they were there in* 1863. He says he 'is certain as to the last date.' Unless there is some mistake in this, we have here a small area of a third brood—Professor Riley's Brood No. XV."

Professor Bessey himself classed this report among the doubtful ones, and it will be best not to adopt it without further corroborative testimony.

BROOD XVI.—*Tredecim*—1880, 1893.

In the year 1880, being the same as the preceding, they will, in all probability, appear in the northern part of Cherokee County, Georgia, having appeared there, according to Dr. Smith, in 1828, 1841, 1854, and, according to Dr. Morris, in 1867. This brood occurred in 1867 simultaneously with the northern *septendecim* Brood XXI.

Like the other broods recorded from northern Georgia, this Brood XVI has since remained without confirmation. It seems difficult to get information on the appearance of the Cicada in that portion of the country, which on account of the interlocking and overlapping of several broods there, is of especial interest and importance in a correct chronology. I would especially urge correspondents from that region to send me data.

BROOD XVII.—*Septendecim*—1881, 1898.

In 1881, and at intervals of 17 years thereafter, they will, in all probability, appear in Marquette and Green Lake Counties, in Wisconsin, and may also appear in the western part of North Carolina and about Wheeling, W. Va., in northeast Ohio, and a few in Lancaster County, Pennsylvania, and Westchester County, New York.

There is abundant evidence that they appeared in the counties named in Wisconsin in 1864, and fair evidence that they appeared that year in Summit County, northeastern Ohio, while straggling specimens were found in the same year by Mr. S. S. Rathvon, in Lancaster County, Pennsylvania, and by Mr. James Angus, in Westchester County, New York. Dr. Fitch also records their appearance in 1847, or 17 years previously, in the western part of North Carolina, and Dr. Smith in Wheeling, W. Va., in 1830, 1847, and 1864. The distance between the localities given is very great, and it is doubtful whether all these records belong to one and the same brood.

1881.—The more southern localities given for this brood, viz., North Carolina and West Virginia, remained unconfirmed, and are thus rendered even more doubtful now than they were when I wrote the above, in 1868. I have also no further records from northeastern Ohio, but from the remaining States confirmatory reports were received in 1881. From Wisconsin, Dr. J. A. Renggly, of La Crosse (letter of October 20, 1881), records the appearance of the Cicada in La Crosse County; and J. W. Wood, of Baraboo (letter of June 28, 1881), stated that they were abundant in 1881 in Sauk County, and still more abundant in 1864. From New York State they were reported by Mr. William T. Davis, of Tompkinsville (letters of June 24 and July 6, 1881), who observed the Cicadas on Staten Island; and from this locality they seem to extend into

New Jersey, as Mr. M. S. Crane, of Caldwell, Essex County, found specimens near his place on May 30. In his letter of August 3, 1881, he says: "Several days before May 30 I had heard their shrill a few times, and an occasional one was heard for a week or so afterward." In Pennsylvania they were observed in small numbers near Germantown by Mr. Henry C. Haines (letter of June 24, 1881). In the eastern States this brood evidently does not appear in very numerous swarms, the main body being apparently in Wisconsin and perhaps farther west. That this brood occurs west of Wisconsin is rendered very probable by the following communication by James C. Merrill, captain and assistant surgeon, U. S. A., from Fort Custer, Montana Territory, dated July 11, 1881: "During a collecting trip to the Big Horn Mountains, early in June, I found the Cicada extremely abundant on the northern slope of this range. They were most common at a height of about 4,500 feet, thence upwards about 1,500 feet to the lower growths of pines, where a few only were found. Their favorite resorts were in patches of cherry brush, each little bush having from two or three to a dozen or more Cicadas upon it; and in riding through such places the noise of these insects was almost deafening. They do not appear to occur far from the mountains, even along the streams flowing out. They were observed on both sides of the Montana-Wyoming line. Their presence seems to be appreciated by the trout, which would refuse even their favorite grasshoppers for the Cicada."

Brood XVIII.—*Tredecim*—1881, 1894.

In the year 1881, and at intervals of 13 years thereafter, they will, in all probability, appear in southern Illinois, throughout Missouri, with the exception of the northwestern corner, in Louisiana, Arkansas, Indian Territory, Kentucky, Tennessee, Mississippi, Alabama, Georgia, and North and South Carolinas.

Though, as already stated, I published the first account ever given of the existence of a 13-year brood,* yet, besides the others mentioned in this chronology, this particular brood has been traced since as having occurred in the years 1816, 1829, 1842, 1855, and 1868; and Mr. L. W. Lyon, at the July (1868) meeting of the Alton (Ill.) Horticultural Society, even mentioned its appearance in 1803.

In Missouri it occurs more or less throughout the whole State, with the exception of the northwest corner, that is bounded on the east by Grand River and on the south by the Missouri River.† The southeast part of the State, where Dr. Smith has recorded it since 1829, is most thickly occupied. I enumerate those counties in which there is undoubted evidence of their appearance during the present year (1868) viz: Andrain, Bollinger, Benton, Clark, Chariton, Callaway, Cooper, Cole, Franklin, Gasconade, Iron, Jefferson, Knox, Lewis, Marion, Macon, Morgan, Moniteau, Pike, Phelps, Pulaski, Polk, Pettis, Schuyler, Saint Charles, Saint Louis, Saint François, Saint Clair, Warren, and Washington.

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* See note, p. 5, for facts ascertained since the above was written.

†As Mr. William Kaucher, of Oregon, Holt County, saw a few individuals in the northeastern part of Buchanan County in 1855, it may occur in small numbers in districts even north of the Missouri River.

It not improbably overlaps some of the territory occupied by the *septendecim* Brood XIV, but I do not think it extends into Kansas.

In Illinois it occurs more or less throughout the whole southern half of the State, but more especially occupies the counties from the southern part of Adams County along the Mississippi to the Ohio, up the Ohio and Wabash Rivers to Edgar County, and then across the center of the State, leaving some of the central counties in southern Illinois unoccupied. To be more explicit, I enumerate all the counties in which it undoubtedly occurred during the present year (1868): Adams (south part, back of Quincy), Bond, Clinton (northwest corner, adjacent to Madison), Champaign, Coles, Crawford, Cumberland, Clay, Clark, Edwards, Edgar* (especially in the eastern part), Franklin, Gallatin, Hardin, Hamilton, Johnson, Jasper, Jersey, Jefferson, Lawrence, McLean (east end), Macon, Madison, Marion, Massac, Monroe, Pike, Perry, Piatt, Pope, Richland, Randolph, Sangamon, Saline, Saint Clair, Union (northeast corner), Washington, Wayne, Wabash, Williamson, and White. There were none the present year either at Decatur, in Macon County, or at Pana, in Christian County; nor were there any at Bloomington or Normal, in McLean; nor in Dewitt County, which lies south of McLean; nor in Spring Creek, Iroquois County, which is northeast of Champaign

In Kentucky, according to Dr. Smith, it occurred in the northwest corner of the State, about Paducah and adjacent counties south, in 1829, 1842, and 1855, and it occurred there in 1868.

In Arkansas it occupied all the northern counties in 1842, 1855, and 1868.

In Alabama it occupied Russell and adjacent counties on the east side of Black-Warrior River in 1842, 1855, and 1868.

In Tennessee it occupied Davidson, Montgomery, Bedford, Williamson, Rutherford, and adjacent counties in 1842, 1855,† and 1868.

In North Carolina it appeared in Mecklenburg County in 1829, 1842, 1855, and 1868.

In South Carolina, the Chester district, and all the adjoining country to the Georgia line west and to the North Carolina line north, was occupied with it in 1816, 1829, 1842, 1855, and 1868.

In Georgia it has occurred in Cherokee County since the year 1816.

In Louisiana it appeared in Morehouse, Caddo, Claiborne, Washington, and adjacent parishes in 1855 and 1868.

It also doubtless occurs in Mississippi and Indian Territory, though I am unable to specify any localities.

1881.—This is not only by far the largest 13-year brood, but also one of the best known of all recorded broods, as can be readily seen from the numerous localities where it was observed in 1868 and at previous visits. Its reappearance in 1881 was equally well observed and recorded, and the communications received and the other dates collected that year nearly equal in number those received since 1868 relating to the other twenty-one broods combined.

In Missouri and Illinois its localities are so well known and established in the above-quoted account that it would be superfluous to give here in detail the numerous confirmatory reports of 1881 which I have from nearly every county mentioned above. In Illinois the extent of the brood was studied by Prof. S. A. Forbes, of Normal, and Mr. John C.

* Edgar County also has the *septendecim* Brood III.

† Though Cicadas occurred in large numbers in Davidson County and other portions of Tennessee in 1855, and also in 1868, yet in Lawrence County they appeared in 1856, instead of 1855—another instance of a belated brood.

Andras, of Manchester, and upon their authority Green and Morgan counties have to be added to the list.

From Kentucky I had no direct news in 1881, but they appeared there in that year, according to an article in the *Scientific American* for July 9, 1881. Specified localities are, however, not given.

In Arkansas the article just alluded to records them in large numbers at Little Rock, Fort Smith, and Hot Springs. Rev. W. C. Stout, of Hawkstone P. O., wrote me recording them from Conway County, and stating his knowledge of their appearance in 1842, 1855, 1868, and 1881. Mr. M. F. Markle, Hazen, Prairie County (letter of June 4, 1881), announces the appearance of the Cicadas at his place. Mr. J. J. Brown, in a communication to *Colman's Rural World*, January 1, 1873, states that the Cicada occupied that portion of northwestern Arkansas which is watered by White River and its tributaries, having appeared regularly every thirteen years since it was settled by the whites. From his own observations he traces them back to 1842, and believes "that they have been steadily decreasing in numbers for the past sixty-nine years, or since 1803."

Mr. John D. Wilkins, Selma, Ala., took particular pains to ascertain the extent of the brood in Alabama, and, as the result of his inquiries and observations, he wrote me, July 11, 1881, that the Cicadas occupied that year the central and northern portions generally, notably Dallas, Perry, Lowndes, Montgomery and Blount Counties and adjacent districts, and that they were most abundant in the northern period. Other confirmatory reports were received from the counties mentioned by Mr. Wilkins, while, according to the *Scientific American* of July 9, 1881, they extended in Alabama as far south as Mobile.

In Tennessee they were observed in 1855 and 1868 in the vicinity of Nashville by Mr. William Prichard, of that place (letter of January 5, 1873), and Mr. George McKnight, of Yorkville, Gibson County, stated, in a letter of April 23, 1881, that in 1868 the Cicadas appeared generally throughout middle Tennessee.

In Georgia, Mr. John Murphy, of Fairburn, Campbell County (letter not dated), observed them in his county in 1842, 1855, and 1868, and they appeared also, according to D. C. Sutton, in 1868, in Walker County and the northwestern part of the State in general.

From North Carolina Mr. Calvin J. Cowles, of the United States assay office at Charlotte, was kind enough to furnish the following data on the distribution of the Cicada in 1881 (letter of April 28, 1882): "They were here [at Charlotte], and they were in Iredell County, extending from a point a few miles west of Statesville to the Alexander and Wilkes County line, and running over so as to embrace the Brushy Mountain section to a point 8 miles southeast of Wilkesboro', and on up the range of mountains to the vicinity of Lenoir, in Caldwell County."

In South Carolina Mr. Henry Trescott, of Pendleton, Anderson

County, observed the Cicadas in 1881 in Anderson, Oconee, and Pickens Counties.

From Louisiana no information has reached me since 1868, and the same holds true of Indian Territory, but I have no doubt that the "upland brood" alluded to by Mr. W. S. Robertson, of Muscogee P. O., in connection with Brood XIV (*vide* p. 33), must be referred to this Brood XVIII.

Mississippi, as I suspected in 1868, must be added to the States in which this brood occurs, as it was observed in 1881 at Kirkwood, Madison County, by Dr. E. H. Anderson (letter of May 3, 1881).

The State of Virginia must also be added to the vast region occupied by this brood, since Mr. Calvin J. Cowles, of Charlotte, N. C., says in his letter referred to above: "They were published as being noisy and numerous in Prince George County, Virginia." This county is in the southeastern portion of the State.

A most interesting and quite unexpected addition to our knowledge of this brood is contained in the following letter from Dr. B. F. Kingsley, acting assistant surgeon, United States Army, of Fort Quitman, El Paso County, Texas, dated July 5, 1881:

"Having just read your very interesting letter to the *Tribune*, dated Washington, D. C., June 16, 1881, relative to Cicadas, I take pleasure in complying with your solicitation for reports from different sections, concerning the Cicada. About the 20th of May they made their appearance in this section in immense numbers. Every tree and bush from El Paso, Tex., to this point and below, a distance of over 100 miles, was literally alive with them. About two weeks ago they disappeared as suddenly as they came. Six weeks previous to the appearance of the Cicada the cottonwood trees in this valley (of which there are a great many) were covered with a species of caterpillar, which rapidly disappeared upon the advent of the Cicada. The arrival of one and departure of the other seem to have been simultaneous. What, if any, the connection was, I am unable to say;* perhaps only a coincidence. I cannot say whether the Cicadas were confined to the valley, or were equally as widespread over the prairie."

These Cicadas along the extreme western boundary of Texas belong, without question, to this Brood XVIII, which thus occurs in every one of the Southern States, except Florida,† and also in the adjacent portions of some of the more northern States. Its occurrence in the Rio Grande Valley even renders it quite probable that it occurs in New Mexico and Mexico, and it will probably be found to extend along the bottom woods of the upper Colorado, Brazos, and other rivers in Texas.

* There is of course no connection whatever between this caterpillar, whatever species it may have been, and the Cicada.

† The Periodical Cicada does not seem to extend into the peninsula of Florida: in fact, with the exception of the extreme northwestern corner, no broods have ever been observed in that State.

BROOD XIX.—*Septendecim*—1882, 1899.

In the year 1882, and at intervals of seventeen years thereafter, they will, in all probability, appear in Monroe, Livingston, Madison, and adjacent counties, and around Cayuga Lake, in New York.

Mr. T. T. Southwick, of Manlius, Livingston County, records their appearance there in 1865, and, as will be seen by referring to the *Prairie Farmer*, vol. 16, p. 2, they appeared during the same year near Cayuga Lake, while Dr. Smith records their appearance in 1797, 1814, 1831, and 1848.

In addition to the above recorded data, I received a communication from Mr. T. E. Hayward, of Pittsford, Monroe County, New York, dated February 13, 1878, in which he speaks of this brood as follows:

"It lies wholly on the east side of the Genesee River, and is bounded by Lake Ontario on the north and probably Cayuga Lake on the east, and extends south 40 or 50 miles to the pine region. You are well aware that it occupies the oak and hickory portions only, and of course there are whole townships within this space where it is scarcely known. This is the 17-year kind, and the first appearance I saw was in 1831, the next in 1848, and again in 1865, and of course they will put in an appearance in 1882, the very year left blank by all the broods then known to exist."

1882.—In this year the reappearance of the brood was communicated to me by Mr. Simon Forshay, of Penn Yan, Yates County, New York (letter of July 10, 1882), and the same correspondent furnished later (letter of October 9, 1882) the following data: "My means to obtain data in this Cicada matter are quite limited, and therefore I can only furnish you with the following: There are two districts in this county (Yates), the towns of Forrey and Middlesex, where these Cicadas were prevalent in great numbers during a part of June and July. Their extent in Forrey covered an area of about four square miles, and in Middlesex somewhat less. These towns or localities are situated at some distance from each other, one bordering on Seneca Lake and the other on Canandaigua Lake. I am also informed that these insects were prevalent in portions of the counties of Ontario, Livingston, and Wyoming, of western New York. I am not able to learn that they made their appearance in any other parts of the State."

While there cannot be the least doubt as to the genuineness of this brood, its small extent, covering only a few counties in a single State, is certainly noteworthy. It is a mere local swarm when compared with most other well-established broods of the 17-year race, and other similar swarms of still smaller extent can no doubt be traced in various parts of the country; for I have a number of communications testifying to the appearance of the Cicada in restricted localities which cannot be referred to any of the established broods, not even as precursors or belated specimens. It would be premature to establish for every one of these locally restricted swarms a new brood, based as they are upon a single record, and their consideration is therefore deferred until more material has accumulated for a thoroughly revised chronology.

BROOD XX.—*Septendecim*—1883, 1900.

In the year 1883, and at intervals of seventeen years thereafter, they will, in all probability, appear in western New York, western Pennsylvania, and eastern Ohio. In the last mentioned State they occur more especially in Mahoning, Carroll, Trumbull, Columbiana and adjacent counties, overlapping, especially in Columbiana County, some of the territory occupied by Brood XV. In Pennsylvania they occupy nearly all the western counties, and their appearance is recorded in 1832, 1849, and 1866, by Dr. Fitch (his second brood), Dr. Smith, and several of my correspondents, the following counties being enumerated: Armstrong, Clarion, Jefferson, Chemung, Huntingdon, Cambria, Indiana, Butler, Mercer, and Beaver.

1883.—This is one of the smaller broods which does not seem to have attracted much attention in 1883. Only two communications of a positive character regarding its reappearance in that year have reached me, both of them from Pennsylvania. Mr. J. S. Elder, of Darlington, Beaver County, wrote me, June 7, 1883: "I heard the 17-year Cicada this morning for the first; they were expected this year," and Dr. J. M. Toner also brought me, on June 16, 1883, specimens from New Derry, Westmoreland County, stating at the same time that he had known them in 1832, 1849, and 1866 in the same locality. Some time in the earlier part of July, 1883, an item appeared in the *New York Herald* stating that "a swarm of locusts" is doing much damage in Chautauqua County, New York. I wrote for further information to Mr. Newel Cheney, of Poland Centre, of that county, but after careful inquiries he failed to confirm the statement.

The appearance of the Cicadas in 1866 in northwestern Pennsylvania was verified by several correspondents, notably by Mr. J. C. Hamm, now of Humboldt, Kansas.*

BROOD XXI.—*Septendecim*—1884, 1901.

In the year 1884, and at intervals of seventeen years thereafter, they will, in all probability, appear in certain parts of North Carolina and central Virginia. In 1850 and 1867 they appeared near Wilkesboro', N. C., and were also in central Virginia during the last mentioned year, while Dr. Smith mentions them as occurring in Monroe County and the adjacent territory in West Virginia in 1833 and 1850.

Dr. Harris (Inj. Insects, p. 210) records their appearance at Martha's Vineyard, Massachusetts, in 1833, but as I cannot learn that they were there, either in 1850 or 1867, I infer that Dr. Harris's informant was mistaken.

1884.—In the year 1883 I received through the Smithsonian Institution specimens from Loudoun County, Virginia, and these were doubt-

* Whether the following letter, dated August 2, 1883, which we received from Mr. O. C. Mortson, of Clendenin, Meagher County, Montana, refers to the Periodical Cicada or to another species of Cicada cannot be definitely determined, as I received no specimens. I simply quote it in order to draw attention to the possibility of a brood of the Periodical Cicada occurring in western Montana: "The 17-year locust has made its appearance in large numbers on the south timbered slope of the Judith Basin, also near Missoula on the headwaters of the Columbia River. The insect I know to be a Cicada, as it is three-fourths of an inch long, with wings 1½ to 1¾ inches long, with tissues forming a W, and when jumping past you sounds almost like a rattlesnake. They hatched out about July 13, and are still here."

less forerunners of this Brood XXI. On account of my absence in Europe I obtained no further data in 1884 for the more southern localities, but for Martha's Vineyard Prof. C. E. Bessey published the following note in the *American Naturalist*, October, 1883: "While driving across 'the plains' of the central part of Martha's Vineyard, Massachusetts, in the last few days of Jun · of this year, I observed large numbers of the Periodical Cicada (*Cicada septendecim*). The scrub oaks, which here cover the whole ground, were literally alive with them. Specimens of twigs containing eggs were secured, as also of the insects themselves and their abandoned pupa skins. * * * The insects were confined to a narrow belt not exceeding half or three-quarters of a mile in width and of unknown length, and possibly this may account for the fact that the inquiries referred to above failed to elicit any knowledge of previous visitation. Supposing Dr. Harris to be right, we have here a slight acceleration in development, due probably to the well-known milder climate of the island." In the editorial remarks to this note I considered this limited appearance on Martha's Vineyard as precursive to Brood XXI, but there is yet some doubt about its real position.

Brood XXII.—*Septendecim*—1868, 1885.

In the year 1885, and at intervals of seventeen years thereafter, they will, in all probability, appear on Long Island; at Brooklyn, in Kings County, and at Rochester, in Monroe County, New York; at Fall River, and in the southeastern portion of Massachusetts; in Rutland County, Vermont; in Pennsylvania, Maryland, District of Columbia, Delaware, and Virginia; in northwestern Ohio, in southeastern Michigan, in Indiana, and Kentucky.

This brood has been well recorded in the East in 1715, 1732, 1749, 1766, 1783, 1800, 1817, 1834, 1851, and 1868. It is spoken of in *Hazzard's Register* for 1834, published in Philadelphia, while Mr. Rathvon has himself witnessed its occurrence during the latter four periods in Lancaster County, Pennsylvania.

It is the fourth brood of Dr. Fitch, who only says that it "reaches from Pennsylvania and Maryland to South Carolina and Georgia, and what appears to be a detached branch of it in the southeastern part of Massachusetts." He is evidently wrong as to its occurring in South Carolina and Georgia, and it is strange that he does not mention its appearance in New York, for Mr. F. W. Collins, of Rochester, in that State, has witnessed four returns of it there, namely, in 1817, 1834, 1851, and 1868, while the Brooklyn papers record its appearance there the present season (1868). As these two points in the State are about as far apart as they well can be, the intervening country is probably more or less occupied with this brood.

Mr. H. Rutherford, of Rutland County, Vermont, records their appearance in that neighborhood in 1851 and 1868. (*New York Semi-Weekly Tribune*, June 27, 1868.) He also witnessed them in the same place in 1855, and, as will be seen by referring to Brood XVIII, they also occurred on Long Island and in southeastern Massachusetts in that same year, 1855. Exactly thirteen years intervening between 1855 and 1868, one might be led to suppose that they had a *tredecim* brood in the East. But did such a brood exist, it would certainly have been discovered ere this, in such old settled parts of the country, and all the records go to show that they have nothing but *septendecim* there. By referring to Brood VIII, the mystery is readily solved, for we find that in that part of the country there are two *septendecim* broods, the one having last appeared in 1855, the other the present year, 1868.

In Ohio, the brood occurred more or less throughout the whole western portion of the State, for our correspondents record them as having appeared in 1868 in Lucas and Hamilton and several intervening counties. Mr. F. C. Hill, of Yellow Springs, in Greene County, southwestern Ohio, has witnessed their appearance in 1834, 1851, and 1868, and they occurred in the northwestern part of the State during the three same years; while the correspondent to the Department of Agriculture, from Toledo, northwestern Ohio (July, 1868, Monthly Report), says it is their ninth recorded visit there. Dr. Smith records it as occurring around Cincinnati, and in Franklin, Columbiana, Pike, and Miami Counties.

In Indiana there is reliable evidence of their appearance in 1868 in the southern part of the State, in Tippecanoe, Delaware, Vigo, Switzerland, Hendricks, Marion, Dearborn, Wayne, Floyd, and Jefferson Counties. The evidence seems to show that, as in Ohio, throughout the State, they belong to the *septendecim* Brood XXII, for Mr. F. Guy, of Sulphur Springs, Mo., has personally informed me that they were in southern Indiana in 1851, and even in Tippecanoe County, on the Wabash River, where, from their proximity to Brood XVIII, one might have inferred them to be *tredecim*: they are recorded as appearing in 1834 and 1851.

In Kentucky they appeared around Louisville. In Pennsylvania, Maryland, Delaware, and Virginia the territory occupied by this brood is thus described by Dr. Smith: "Beginning at Germantown, Pa., to the middle of Delaware; west through the east shore of Maryland to the upper part of Anne Arundel County; thence through the District of Columbia to Loudoun, West Virginia, where it laps over the South Virginia district (see Brood XII) from the Potomac to Loudoun County, some 10 or 12 miles in width, and in this strip of territory Cicadas appear every eighth and ninth year. Thence the line extends through the northern counties of Virginia and Maryland to the Savage Mountains, and thence along the southern tier of counties in Pennsylvania to Germantown.

Since the above was published, seventeen years ago, I have received reliable testimony to the effect that Dr. Fitch may, after all, be right in extending this brood as far south as Georgia, as will be seen by referring to the notes to Brood II, and it is to be hoped that this year's (1885) observations may definitely settle this interesting point. The counties in Georgia where the appearance of the Cicada may be looked for this year are those of the extreme northwestern corner, and more especially Habersham County.

Otherwise the notes I have since received do not alter the boundaries of this brood as given above. In 1868 the Cicadas appear to have been extremely numerous in the city of Germantown, Pa., as will be seen from the following extract from a letter we received on June 6, 1881, from Mr. John B. Wood, of that city: "In the year 1868 my wife being sick nearly all summer she was very much disturbed by what we called 17-year locust. They seemed to come up out of the ground from under the pine trees, but preferred climbing up a large pear tree, going out to the end of the branches and stinging the pears. They were in thousands, some of them roaring out and others replying to them, making a fearful din, which we were powerless to overcome. The ground around this pear tree, and a few pines covering a section of land, I should say 20 or 30 feet square, was fairly riddled with their holes. All around here they appeared in this way in spots, but filling the air with their racket. They were in full blast by the 19th of June." The

inhabitants of Lancaster, Pa., will also have the opportunity this year of listening to the music of the Cicadas within the limits of their city, as Mr. S. S. Rathvon saw them abundantly at that place in 1868.

The late F. S. Sleeper, of Galesburg, Kalamazoo County, furnished me the following interesting statement regarding the distribution of the Cicada in his county: "During 1868 they appeared in great numbers in this locality, being confined to a narrow strip about four miles in width through the northern part of this county. In this strip the ground was fairly honeycombed in appearance where they came up. There were some scattering ones out of this strip. My mother states that they were very abundant seventeen years previous (1851)."

Regarding the extent of this brood in northwestern Ohio and the dividing line between this and Brood XV, compare the letter of Mr. J. H. Niles, of Havana, Huron County, Ohio, which I quoted on p. 34. In the same letter Mr. Niles continues as follows: "Five miles west of this dividing line, in the northeast corner of Seneca County and the adjoining corner of Sandusky County, is located the brood of 1885. They occupy only some 30 square miles, and are on a cluster of ridges of the ancient lake coast deposit, overlaying the limestone soils."

This is the largest 17-year brood on record, and although it does not appear to reach the Mississippi River it certainly equals in extent the largest 13-year Brood XVIII, both broods having appeared simultaneously in the year 1868. In the more northern States this Brood XXII appears to be broken up in several isolated detachments, while its southern extension, viz., from North Carolina to northern Georgia, is not yet established as fully as might be desired.

SUMMARY OF DISTBIBUTION AND FUTURE APPEARANCE.

Summing up the distribution of the Periodical Cicada (both 17- and 13-year races) within the United States, as specified in the above enumeration of the different broods, it will be seen that the Cicada is known to occur in all the States east of the plains excepting the northern portion of New England, northern Michigan, and the whole of Minnesota. It thus appears that this Cicada does not breed in those northern States or portions thereof in which the woods are composed more or less exclusively of pine trees or other conifers. Rhode Island possesses no broods so far as we know, but this may be due to want of proper records, as several broods reach close to the borders of that State. Neither does the species occur in the peninsula of Florida, for reasons either of a climatic or geologic nature. Our knowledge of the western extent has greatly increased since 1868, and several broods can now be traced as far west as eastern Montana and Wyoming, central Colorado, and the extreme western parts of Texas, while less reliable evidence even indicates (*vide* Brood XX) that the species may occur in western Montana along streams emptying into the Pacific Ocean. Unless this report

be substantiated in future the distribution will not extend beyond the dividing range of the Rocky Mountains. The connection between the distribution of this insect and the botanical, geological, and topographical characteristics of the country forms a very interesting subject for consideration, and I hope to consider it in a future edition of this Bulletin.

The following summaries may be made, for convenience, from the foregoing chronological account, the Roman numerals indicating the number of the brood, and the asterisk the 13-year broods.

During the next seventeen years there will occur broods of the Periodical Cicada somewhere or other in the United States, in the following years:

1885. VII* and XXII.
1886. I.
1888. V and X*.
1889. VIII.
1891. IX.
1893. XI and XVI*.
1894. XII and XVIII*.
1895. II* and XIII.
1896. IV* and XIV.
1897. VI* and XV.
1898. VII* and XVII.
1899. XIX.
1900. XX.
1901. X* and XXI.

Thus every year except 1887, 1890, and 1892, will, during the next seventeen years, be somewhere a Cicada year; and it will be noticed that the 13-year broods invariably concur with some 17-year brood, a fact which is worthy of note and which leads to interesting speculation as to the origin of the former.

It further appears that the number of distinct broods appearing in different years within the same geographical limits are as follows:

ALABAMA.—Two broods; years 1894 [XVIII*] and '96 [IV*], and probably another in 1888 [X*].

ARKANSAS.—Two broods; years 1885 [VII*] and '94 [XVIII*].

COLORADO.—One brood; year 1891 [IX].

CONNECTICUT.—Two broods; years 1886 [I], and 1894 [XII].

DELAWARE.—Two broods; years 1885 [XXII] and '89 [VIII].

DISTRICT OF COLUMBIA.—Two broods; years 1885 [XXII] and '94 [XII].

FLORIDA.—One brood; year 1896 [IV*].

GEORGIA.—Five broods; years 1885 [two broods VII* and XXII], '93 [XVI*], '94 [XVIII*], and '95 [II*].

ILLINOIS.—Six broods; years 1885 [VII*], '88 [V], '89 [VIII], '93 [XI], '94 [XVIII*], and '95 [XIII].

INDIAN TERRITORY.—Two broods; years 1894 [XVIII*] and '96 [XIV].

INDIANA.—Five broods; years 1885 [XXII], '88 [V], '89 [VIII], '93 [XI], and '94 [XII].

IOWA.—Two broods; years 1888 [V] and '95 [XIII].

KANSAS.—Two broods; years 1885 [VII*] and '96 [XIV].

KENTUCKY.—Three broods; years 1885 [XXII], '89 [VIII], and '94 [XVIII*].

LOUISIANA.—Three broods; years 1885 [VII*], '94 [XVIII*], and '97 [VI*].

MARYLAND.—Four broods; years 1885 [XXII], '89 [VIII], '93 [XI], and '94 [XII].

MASSACHUSETTS.—Four broods; years 1885 [XXII], '86 [I], '89 [VIII], and 1901 [XXI].

MICHIGAN.—Two broods; years 1885 [XXII] and '88 [V].

MISSISSIPPI.—Four broods; years 1885 [VII*], '94 [XVIII*], '96 [IV*], and '97 [VI*].

MISSOURI.—Four broods; years 1885 [VII*], '94 [XVIII*], '95 [XIII], and '96 [XIV].

MONTANA AND WYOMING.—One brood; year 1898 [XVII].

NEBRASKA.—Two broods; years 1891 [IX] and '96 [XIV].

NEW JERSEY.—Two broods; years 1889 [VIII], and '94 [XII].

NEW YORK.—Five broods; years 1885 [XXII], '89 [VIII], '94 [XII], '99 [XIX], and 1900 [XX].

NORTH CAROLINA.—Seven broods; years 1885 [XXII], '89? [VIII], '93 [XI], '94 [two broods XII and XVIII*], '98? [XVII], and 1901 [XXI].

OHIO.—Seven broods; years 1885 [XXII], '89 [VIII], '95 [XIII], '96 [XIV], '97 [XV], '98 [XVII], and 1900 [XX].

PENNSYLVANIA.—Six broods; years 1885 [XXII], '88 [V], '89 [VIII], '94 [XII], '97 [XV], and 1900 [XX].

SOUTH CAROLINA.—Two broods; years 1885 [XXII] and '94 [XVIII*].

TENNESSEE.—Three broods; years 1885 [VII*], '94 [XVIII*], and '96 [IV*].

TEXAS.—Three broods; years 1888 [X*], '94 [XVIII*], and '96 [XVIII*].

VERMONT.—One brood; year 1885 [XXII].

VIRGINIA.—Four broods; years 1885 [XXII], '94 [two broods XII and XVIII*], and 1901 [XXI].

WEST VIRGINIA.—Four broods; years 1889 [VIII], '97 [XV], '98 XVII], and 1901 [XXI].

WISCONSIN.—Two broods; years 1888 [V] and '98 [XVII].